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**Environmental education and its potential to support  
conservation activities**

Ph.D. Thesis

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## **DECLARATION**

I hereby declare that I conducted this dissertation thesis entitled 'Environmental education and its potential to support conservation activities' independently. All texts in this thesis are original, and all the sources have been quoted and acknowledged by means of complete references and according to citation rules of the FTA. All photographs in this document were taken by myself or are used with authorisation and quoted author.

In Prague 19. 6. 2019

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Markéta Grůňová

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## ABSTRACT

**Thesis title:** Environmental education and its potential to support conservation activities

Short-duration environmental education programmes and nature excursions are commonly used by conservationists to influence recipients' environmental attitudes. Nevertheless, gaps in its evaluation still remain and its effectiveness is therefore not clearly assessed. This thesis summarises research realised within Western Derby Eland (*Taurotragus derbianus derbianus*) conservation's environmental education activities in 2008-2016 in Senegal. Pilot study conducted in the surroundings of the Fathala reserve, Senegal evaluated the effect of environmental education programmes on primary schoolchildren's knowledge and specific attitudes related to nature conservation (n=350). It was found that the desired change was achieved in environmental knowledge of targeted children, but not measured specific attitudes. Nevertheless, it was concluded that a systematic evaluation tool was missing and that one of the validated environmental attitudes scales should be used in the following evaluation. Study realised in 2015 in six Senegalese regions aimed to test in western world validated New Environmental Paradigm scale for children and to examine its validity in the Senegalese settings (n=765). Low correspondence with valid hypothetical New Environmental Paradigm scale structure was detected by Confirmatory Factor Analysis and its factors were loaded significantly differently than in the original model. Based on low consistency of the scale in our settings, the scale was assessed item by item, when used in 2015-2016 to evaluate the effect of the environmental education programme for primary schoolchildren in the proximity of the Bandia reserve, Senegal (n=303). A 10-item version of the New Environmental Paradigm scale for children complemented by four attitude questions related to the Derby eland conservation and three environmental knowledge questions, were used in a pre-, post-, and long-term survey. In this study it was specifically investigated whether a two-day environmental programme in class and/or one-day programme in class followed by 1-day outdoor excursion lead to positive changes in Senegalese children's environmental knowledge and attitudes. The author concludes that both versions of the short duration environmental education programme i.e. in class and with outdoor excursion only had a limited, positive effect on children's environmental attitudes. Outdoor excursion to a nature reserve did not prove more efficient in influencing children's environmental attitudes compared to corresponding indoor programme.

**Keywords:** Derby Eland, endangered species, environmental attitudes, environmental awareness, environmental education programme evaluation, New Environmental Paradigm, protected area, Senegal, West Africa, wildlife conservation

## ABSTRAKT

**Název práce:** Environmentální vzdělávání a jeho potenciál podpory ochranných aktivit

Krátkodobé vzdělávací programy a venkovní exkurze jsou často využívané nástroje ochránců přírody, kteří jejich prostřednictvím ovlivňují postoj k životnímu prostředí cílové skupiny. V evaluaci těchto programů zůstávají mezery a jejich efektivita tedy není jasně zhodnocena. Tato disertační práce přináší výsledky výzkumu realizovaného mezi lety 2008-2016 v rámci vzdělávacích aktivit při záchranném programu západního poddruhu antilopy Derbyho (*Taurotragus derbianus derbianus*) v Senegalu. Pilotní studie realizovaná v okolí rezervace Fathala hodnotila dopad dvoudenního environmentálně-vzdělávacího programu na znalosti o životním prostředí a specifické postoje k jeho ochraně dětí z místních základních škol (n=350). Po vzdělávacím programu byl u dětí zaznamenán nárůst znalostí o životním prostředí, nikoli však posun v měřených postojích k ochraně životního prostředí. Tato studie také ukázala na chybějící systematický nástroj k měření environmentálních postojů dětí. Z tohoto důvodu jsem se tedy v roce 2015 zaměřila na ověření funkčnosti měřítka environmentálních postojů Nového environmentálního paradigmatu platného v západním světě, a nástroj testovala na dětech z šesti regionů Senegalu (n=765). Faktorová analýza prokázala slabou shodu výsledků s platnou hypotetickou strukturou Nového environmentálního paradigmatu a signifikantně rozdílné rozvrstvení jejich faktorů oproti testovanému modelu. Z důvodu nízké soudržnosti škály byly její položky v následující studii posuzovány jednotlivě. V letech 2015-2016 byl měřen posun environmentálních postojů dětí ze základních škol v okolí rezervace Bandia (n=303) v návaznosti na nově vyvinutý vzdělávací program. Použita byla deseti položková verze Nového environmentálního paradigmatu pro děti, která byla doplněna čtyřmi otázkami týkajícími se specificky ochrany antilopy Derbyho a třemi znalostními otázkami. Žáci byli testováni před programem, po něm a v dlouhodobém horizontu po skončení vlastního programu. V této studii jsme se konkrétně zajímali, zda dvoudenní environmentálně-vzdělávací program ve školní třídě a/nebo jednodenní program ve třídě následovaný jednodenní exkurzí v přírodní rezervaci vedou u žáků k pozitivní změně environmentálních postojů a znalostí. Z výsledků studie plyne, že dvoudenní vzdělávací program, jak ve školní třídě, tak doplněný o exkurzi do přírodní rezervace, měl pouze omezený pozitivní vliv na postoje žáků k životnímu prostředí. Exkurze do přírodní rezervace nepřinesla ve srovnání s odpovídajícím programem ve třídě lepší výsledky v působení na postoje k životnímu prostředí.

**Klíčová slova:** antilopa Derbyho, chráněná oblast, hodnocení environmentálně vzdělávacích programů, Nové environmentální paradigma, ochrana životního prostředí, ohrožené druhy zvířat, postoje k životnímu prostředí, znalosti o životním prostředí, Senegal, západní Afrika

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## 1. INTRODUCTION

There are 8490 endangered vertebrate species on Earth in 2019 (IUCN, 2019). Loss of species is most often caused by human activities (e.g. Powers & Jetz 2019; Giam 2017) and thus dependent on human behaviour. As discussed in chapter 2.1. and 2.2., this behaviour is influenced by awareness and attitudes of local and also distantly-living human populations.

Environmental education is a broadly used tool to influence people's awareness and attitudes and consequently support conservation actions in both western and non-western world: in Europe (Bogner 1999; Dimopoulos et al. 2008), Americas (Smith-Sebasto 2004; Cummins & Snively 2000; Andrade 2004), Australia (Das 1999), Asia (Foo 2013), or Africa (Kuhar et al. 2012; Mbugua 2012; Pile 1962; Børchers et al. 2014).

Together with calls for evaluation of conservation actions (O'Neill 2007; Jacobson, McDuff et al. 2015; Ferraro & Pattanayak 2006), calls for evaluation of conservation education appear (Norris & Jacobson 1998; Stern et al. 2014). Although conservationists usually have biology, not sociology as background (Carleton-Hug & Hug 2010), they can benefit from a battery of pro-environmental behaviour models developed by sociologists (Schwartz 1968; Ajzen 1991; Bamberg & Möser 2007) and validated attitudes scales shown in chapter 2.6., that serve as a comparable measure of environmental education efforts.

The Western Derby eland (*Taurotragus derbianus derbianus*, Gray, 1847) is a critically endangered mammal (IUCN 2017), with the last wild population estimated at 170 animals (Renaud et al. 2006) living in the Niokolo Koba National Park, Senegal. In 2000, conservation activities were launched by the Directorate of National Parks of Senegal and its partners. A semi-captive population was established in the Bandia Reserve in western Senegal, as its protection could no longer be guaranteed in its natural range in the Niokolo Koba National Park. Nowadays, Senegal possesses the two semi-captive populations of the Western Derby eland in the Bandia and Fathala nature reserves (Brandlová et al. 2013). In both reserves, the Western Derby eland occurs together with other charismatic, large herbivore species, such as the West African Buffalo (*Syncerus caffer brachyceros*), Roan Antelope (*Hippotragus equinus*), White Rhinoceros (*Ceratotherium simum*), Plains Zebra (*Equus quagga*), and Southern Giraffe (*Giraffa giraffe*). The reserves therefore represent a unique tool for raising awareness on environmental issues and providing opportunities for direct contact of people with indigenous wildlife species.



In order to make environmental programmes the most effective possible, various methods of informal education are being used including outdoor excursions (Chipembele 2014; Save the Rhino 2014; Fernan-Vaz Gorilla Project 2014; Espinosa 2012; Liefländer, Fröhlich et al. 2013; Borchers et al. 2014). In 2008, the first environmental education programmes were developed and implemented by Western Derby eland conservation team in the Fathala reserve, south-west Senegal (Grůňová et al. 2017), in order to make use of the opportunities it provides to influence peoples' attitudes towards nature conservation (Bogner & Wiseman 2004; Infield & Namara 2001; Judy 2013). In a series of repeated programmes in 2008-2009, field trips were used to raise awareness and positively influence environmental attitudes of participating schoolchildren. However, these efforts were not systematically evaluated for their effect on changes in environmental attitudes of the participants. Even though the increase in conservation related knowledge was recorded after the programme, some of the monitored children's environmental attitudes shifted slightly positively and some slightly negatively (chapter 5.1.), the lack of systematic monitoring makes results of such evaluation difficult to apply in different settings (Carleton-Hug & Hug 2010; Kopnina 2011). The author of this thesis found this evaluation gap of short-term outdoor excursions to be common within conservation based environmental education programmes. Only few comparative studies investigating effectiveness of a one day outdoor education programme on children's attitudes have been published (Kossack & Bogner 2012; Sellmann & Bogner 2013; Bogner 2002; Frantz & Mayer 2014), no comparative study has been found to be published on effectivity of outdoor excursions within conservation programmes in developing countries so far.

Consequently when new education programmes were recommenced in 2015 within Western Derby conservation, we started to search for a generally applicable measure of environmental attitudes which had been validated on children and could be used to measure the effect of an environmental education programme. Today, the two most widely used measures of environmental beliefs are the Two Major Environmental Values (2-MEV) model (Bogner & Wiseman 1999) and New Environmental Paradigm (NEP) scale (Dunlap et al. 2000). Each has been used once in western Africa: Boerchers et al. (2014) evaluated effectiveness of a long duration environmental education programme in Ivory Coast using 2-MEV scale and Ogunbode and Arnold (2012) examined environmental attitudes of university students using NEP scale.

As described in chapter 2.7., the NEP scale for children seemed a better choice for the purpose of this study. Its disadvantage lied in the fact that it had been used only twice on non-

western children, i.e. in Zimbabwe (Van Petegem & Blicek 2006) and in China (Wu 2012). For this reason we first focused on the reliability of the NEP scale for children in Senegalese settings to explore the scale's consistency on a sample of 765 children in administrative regions in the three departments (chapter 5.2.).

The new education programme was developed for schools in the proximity of the Bandia reserve and a 10-item version of the NEP scale for Children (Manoli et al. 2007) was employed to measure its effectiveness. Three questions were appended to the NEP questionnaire that specifically focuses on conservation issues in Senegal: loss of natural habitat; poaching; lack of empowerment/ belief in one's capacities to preserve nature; and perception of Western Derby eland conservation importance (chapter 5.3.).

The research aim included in this thesis was therefore to find a reliable environmental attitudes measure, which will allow comparison with studies from different environments and will help to assess effectiveness of short-term environmental education programmes and one-day outdoor excursions. Further implication of this research is modifying environmental education programmes alongside Western Derby eland conservation in regard to effectiveness and financial effectivity of its methods.

## 2. LITERATURE REVIEW

### 2.1. Environmental education and conservation

Formalised environmental education (EE) was launched by the Tbilisi Declaration in 1977 based on principles outlined at the Belgrade Conference in 1975 (UNEP 2012). The declaration adopted environmental education as an indispensable instrument for improving the environment at the United Nations Education Scientific, and Cultural Organization's United Nations Environmental Programme (UNESCO-UNEP). This Declaration established a framework for both formal and non-formal EE activities at local, national, and international levels (UNEP 2012). The generally accepted definition of environmental education, accepted by the United Nations Environment programme (UNEP) and stays as '*Environmental education is a process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems, and which has the knowledge, attitudes, motivations, commitments and skills to work individually and collectively toward solutions of current problems and the prevention of new ones.*' (UNESCO-UNEP 1975)

Three years after the Tbilisi declaration, the World Conservation Strategy was launched already mentioning environmental education in context of the transformation of global policies towards achievement of conservation objectives claiming that '*the long term task of environmental education (is) to foster or reinforce attitudes and behaviour, compatible with a new ethic*' (IUCN 1980).

Since 1980s it remains true in the 21<sup>st</sup> century, that extinction of species has been most often caused by human activities (e.g. Powers & Jetz 2019; Giam 2017) and thus, the global population indeed needs to '*work individually and collectively toward solutions of current (environmental) problems and the prevention of new ones*' (UNESCO-UNEP 1975).

The most direct impact on endangered species survival is caused by people sharing the species' closest environment. The success of a potential conservation programme therefore depends on their past, recent and future environmental behaviour (Dickman 2010; Baker et al. 2010; Espinosa & Jacobson 2012) and it is thus common within conservation programmes to run environmental education programmes alongside. Environmental education use within conservation programmes is based on the presumption that 1) the primary condition for the successful conservation of species is ensuring its sustainable habitat; and 2) the probability of

humans' future pro-environmental behaviour can be enhanced by knowledge and attitudes, possibly gained throughout environmental education programmes (Ajzen 1991; Bogner & Wiseman 2004; Bamberg & Möser 2007; Fančovičová & Prokop 2011; Singh & Rahman 2012; Frick et al. 2004; Boeve-de Pauw & Van Petegem 2011).

The influence of local human population on perceived conservation success was described by Struhsaker et al. (2005). They found perceived conservation success in African protected areas to be greatest for areas with low human population densities, support from international donors, effective law enforcement and strong public support. Nosoni et al. (2017) found respondents exposed to a conservation message in Kongo to carry more positive attitudes towards forest elephants than people from logging villages living around a protected area. Borchers et al. (2015) found positive change in respective knowledge and environmental attitudes in children attending extra-curricular environmental classes in Ivory Coast. Cummins and Snively (2000) found a significant increase in knowledge and positive attitude towards local marine resource issues in Canada after public education campaign. Bogner (1999) found a significant positive effect on the specific knowledge level and on two of the five environmental perception subscales after an environmental education programme focused on Common swift (*Apus apus*) for Swiss pupils. On the other hand, contrary to expectations, Struhsaker et al. (2005) found no direct correlation of protected area success with employment benefits for the neighbouring community, conservation education, conservation clubs, or with the presence and extent of integrated conservation and development programs. Neither did Gore et al. (2008) found any evidence for knowledge change or their willingness to adopt environmentally responsible behaviour after a programme to mitigate black bear-human conflict. Dimopoulos et al. (2008) found significant effect on knowledge, but no effect on attitudes of children who went through conservation educational module focused on sea turtle rookery in Greece. Andrade (2004) did not find any significant shift in children's knowledge, attitudes or behavioural intentions toward the environment and the Andean bear in relation to an environmental education programme in Ecuador. Nonetheless environmental education programmes vary in its qualities (Kuhar et al. 2007) and evaluation instruments (Carleton-Hug & Hug 2010). According to Kuhar et al. (2007) not all environmental education is equal and desired change can be achieved by '*building a more complex understanding of the natural world*' and creating positive attitudes. It is also possible that in some cases measure of programme success and programme objectives do not meet (Carleton-Hug & Hug 2010). More focus on programs' evaluation will be put in chapter 2.5.

## 2.2. Knowledge, attitudes and behaviour

At early stages of environmental education it was believed that increased knowledge related to nature protection leads to change in attitudes towards environment which ultimately lead to responsible behaviour (so called knowledge–attitude–behaviour model). It was thus assumed in the 70es and 80es that if we teach learners about something, their behaviour will be directly modified.

Although the first pioneers bringing in more determinants of change in environmental behaviour appeared in 80es (Sia et al. 1985, 1986; Hines et al. 1987), a crucial change in environmental education field was the World conference of education for all in 1990 where Hungerford and Volk (1990) presented evidence that an issue awareness on its own does not lead to change in environmental behaviour and instead introduced a much broader Model of Responsible Environmental Behaviour (REB, Hungerford et al. 1987).

The REB model is based on the norm-activation model (NAM, Schwartz 1977) which viewed pro-environmental behaviour as fuelled by social norms. According to REB direct determinants of pro-environmental behaviour are considered the intention to act and objective situation factors (i.e. external). The intention to act consists of cognitive variables: action skills, knowledge of action strategies and issues; and personality variables: attitudes, locus of control and personal responsibility (Hungerford et al. 1987). The Responsible Environmental Behaviour model had a strong impact on newly emerging researchers who have been encouraged to follow up with investigation on psycho-social determinants of pro-environmental behaviour (Chao 2012; Ajzen 1991). In contrast of NAM, Ajzen (1991) formulated a theory of planned behaviour (TPB) according to which decision making is being done by weighting positive and negative consequences in regard of one's self- interest.

Twenty years after the construction of the REB model, Bamberg and Möser (2007) confirmed pro-environmental behaviour to be a mixture of self-interest and pro-social motives. They found eight psycho-social determinants to be predictors of pro-environmental behaviour; i) a problem awareness, ii) social norm, iii) moral norm, iv) a perceived behavioural control v) feelings of guilt, vi) attitude and vii) intention. Three determinants out of eight accounted in average for 52% variance of intention to conduct a pro-environmental behaviour. Those were iv) perceived behavioural control, vi) attitude and iii) moral norm. An important precondition for developing pro-environmental moral norms and attitudes was found to be problem awareness.

Although the mentioned models show that a link between knowledge, attitudes and behaviour is far not as direct as was believed in the 70es, awareness and attitudes still play an important role in forming pro-environmental behaviour and are thus a relevant measurable outcome of environmental education (Fernández-Manzanal et al. 2013; Hines et al. 1987; Hungerford & Volk 1990; Baruch-Mordo et al. 2011; Rodríguez-Barreiro et al. 2013; Zsóka et al. 2013).

Newly appearing models adjust formation of habits (Hansmann & Steimer 2015) and past behaviour (Whitmarsh & O'Neill 2010) to the list of determinants, or take into account the role of justification in forming pro-environmental behaviour (Hansmann & Steimer 2015).

## **2.2. Demographic variables for environmental attitudes**

Since the emergence of environmental education, researchers started to investigate variables that influence ones' attitudes towards environmental problems. First hypotheses were formed about the role of age, gender, social class, political opinion and place of living (Dunlap & Van Liere 1978; Van Liere & Dunlap 1980) and have since then examined. Understanding the role of environmental attitudes variables can help plan environmental education programmes.

The first review of social bases of public concern of environment came from Van Liere and Dunlap (1980). They reviewed 21 studies for role of demographic variables on environmental concern. In their study age, gender, social class, residence (urban or rural), and political identification were examined. They found evidence for younger higher educated respondents from urban areas to be more concerned for environment, while gender played an inconclusive role. In a more recent review, Cassey and Scott (2006) found female gender, better education, and being older to be associated with higher levels of eco-centric concern for the environment in Australia.

### **2.2.1. Age**

In general, research has shown younger people to be slightly more concerned for environment than older people (Dunlap et al. 2000; Van Liere & Dunlap 1980). According to explanation offered in Van Liere and Dunlap (1980), younger people are less integrated into dominant social order through which older people can perceive environmental solutions as threatening the existing traditional values. On the other hand, when dealing with schoolchildren, age is not anymore a question of generations, but more an issue of cognitive

skills and mental development that schoolchildren undergo every year. In this regard, studies offer mixed results. Liefländer and Bogner (2014) found younger students to be more responsive to an attitude shaping environmental programme than older students. Their possible explanation lies in Piaget's developmental theory according to which younger children between 7 and 11 are in the 'concrete operational stage' and are thus oriented on role models (parents and teachers), from whom they will easily adopt communicated knowledge and attitudes. Their older schoolmates desire emotional autonomy and are more likely to be resistant towards educational messages (Berk 2004; Liefländer & Bogner 2014). On the other hand Boerchers et al. (2014) found children attending sixth grade of primary school more receptive to environmental education in Ivory Coast than fifth graders. From their perspective, older children might have higher potential to integrate new knowledge into their already existing cognitive map.

### **2.2.2. Gender**

In public discussion, women are generally seen as more concerned for environment than men (e.g. in Blaikie 1992; Blocker & Eckberg 1997; Tranter 2011; Boeve-de Pauw & Van Petegem 2010). This can result from the women's role in society as caretakers as summarised in Cassey and Scott (2006) who conclude that '*women and girls (are) traditionally more socialised into caregiver roles which predispose them to be more compassionate, nurturing, and protective*'. An evidence for the role of gender in perception of environment is, however, inconclusive. Van Liere and Dunlap (1980) in their review of 21 studies, found two studies which found moderate positive association of being woman with stronger concern for environment out of which one was their own (Van Liere & Dunlap 1978), two studies with negative association and the remaining studies with inconclusive results. Zelezny et al. (2000) reviewed studies measuring environmental attitudes of respondents by New Environmental Paradigm scale between 1988 and 1998. Four of this studies found that females express significantly greater environmental concern than males, while two studies found no significant difference. In some studies using the Two Major Environmental Values Model (2-MEV; Bogner & Wiseman 2004, 2006; Wiseman et al. 2012) female respondents were found to carry stronger pro-environmental attitudes. No evidence for difference of gender in environmental attitudes was found e.g. in Liefländer and Bogner (2014).

### **2.2.3. Socio-economic settings**

In most of the available studies, it was found that higher reached education was connected to higher pro-environmental attitudes (Dunlap et al. 2000; Howell & Laska 1992; Van Liere & Dunlap 1980; Powers 2004; Kopnina 2011; Tessema et al. 2010, Tranter 2011, Shen & Saijo 2007). Only few studies found no or negative correlation of pro-environmental attitudes with higher education (e.g. Blaikie 1992).

Some studies suggest that positive relationship of higher education and pro-environmental attitudes might not come directly from higher knowledge but from a place in society resulting in experiencing nature as pleasant and valuable (Van Liere & Dunlap 1980; Cassey & Scott). Children's place in society are often given by their parent's education, which has therefore an impact on children's' environmental attitudes. It was confirmed in Casey and Scott (2006) that higher education in the family was associated with higher levels of eco-centric concern for the environment and more reported ecological behaviour. On the other hand, Boeve-de Pauw and Van Petegem (2010) found parental occupation, supposedly resulting from reached education, to be unrelated to environmental attitudes of youth.

One of the first hypotheses about the role of urban or rural settings was formulated by Tremblay and Dunlap (1978). The first assumption presumes urban residents to be more concerned about environment because they face pollution directly and other kinds of environment deteriorations. The second hypothesis sees rural inhabitants as more focused at utilization as from nature of their usual occupation (agriculture, pasture, and logging). Urban residence was a predictor for pro-environmental attitudes of most studies reviewed in Van Liere and Dunlap (1980) and in Howell and Laska (1992).

### **2.2.4. Religion and ethnics**

When it comes to religion, the debate generally deals with religions of Book (Jewish, Christians and Muslims) that suppose mens supremacy over nature and therefore detachment from the natural world (e.g. Eckberg and Blocker 1989; Schultz et al. 2000). Fewer studies are showing Christians to be more concerned about environment than other religious groups (e.g. in Kempton et al. 1995). Interesting insight brought by Munoz et al. (2009) who found similar results on preservation factor on Christians, Muslims and atheists. On the same sample differences were nevertheless found on utilization factors where Muslims appeared to be more in favour of utilization while keeping high preservation scores. This was explained more by cultural settings and the countries level of development than by religion itself.



As in author knowledge, no study has been published on the role of ethnicity in environmental attitudes. This is probably due to the fact that most studies on environmental attitudes have been realised in nations where ethnics play a minority role in society or are neglected.

### **2.3. Environmental education and outdoor excursion**

Generally, there are three types of instruments for achieving goals available in EE. Programs (sequence of activities), information services (media, NGOs'), and supporting materials (booklets, posters, etc.) that we implement contextually in order to achieve the highest EE effectiveness possible (Činčera 2013).

Given the variety of learning strategies, as described by Fremerey and Bogner (2015), a battery of EE approaches and learning programs should follow and present information in different ways corresponding to those strategies. The multimedia learning, for instance, is based on the fact, that pupils learn more deeply from words connected to images than from words alone (Mayer 2009). Outdoor excursions are considered a powerful educational instrument for nature because it can be encountered with different sensory factors and it has potential to go beyond the classroom limitations in terms of emotional content (Bogner & Wiseman 2004). Direct experience with wildlife and its habitat is generally thought to influence peoples' environmental attitudes (Dettmann-Easler & Pease 1999; Fernan-Vaz 2012; Chipembele 2013; Rhino 2014). Frančovičová and Prokop (2011) compared an outdoor learning group with a classroom referential group and found higher scores yielded by those of outdoor intervention. Ajiboye and Olatundun (2010) found a significant effect of outdoor excursions on pupils' environmental knowledge in Nigeria. However not all environmental education programs proved to be more efficient in its non-traditional settings than in classroom settings (Hendee 1972; Zelezny 1999). Zelezny (1999) found pupils in class settings to be more likely active than during an outdoor education and, therefore more affected by education in class. As the organisation of excursions is connected with a heavy financial load, its effectiveness should be considered. However, an empirical evaluation of conservation based environmental education programs is scarce. Above that, as in author knowledge, no quazi-experimental study evaluating effectiveness of short-term outdoor excursions is available within conservation projects.

## 2.4. Environmental education programme evaluation in context of conservation

Conservation programs such as Chipembele (2014) operating close to South Luangwa National Park in Zambia, Save the Rhino (2014) working with local communities on rhino protection in Tanzania and Zimbabwe, Fernan-Vaz Gorilla Project (2014) focused on gorilla protection in Gabon or Andean Bear conservation which run environmental education programme in Ecuador (Espinosa & Jacobson 2012), are specific by the fact that evaluators come mostly from the conservation biology background and hence do not have much theoretical background and experience in the evaluation of education outcomes. As a result, experimental evaluation tools are missing for EE conservation programs and common methodology is scarce (Carleton-Hug & Hug 2010; Monroe 2010).

O'Neil (2007) conducted an audit on evaluation methods of biodiversity conservation projects implemented by large international organisations such as World Wildlife Fund. Out of 37 projects, less than one third included any formal evaluation. Even though the project evaluation proved to be indispensable for many non-governmental organizations conducting social programs (e.g in Cohen & Dupas 2007), it has been still mostly underestimated in EE field (Bogner & Wiseman 1999; Ferraro & Pattanayak 2006; Gore et al. 2008; Carleton-Hug & Hug 2010; Monroe 2010; Baruch-Mordo et al. 2011).

Norris and Jacobson (1998) published a content analysis of 56 reports on tropical conservation education programs published between 1975 and 1990. The analysis revealed that less than one-third reported formative evaluations and only a quarter implemented summative evaluations. Yet, programs that engaged formative or long-term evaluations were significantly more likely to achieve their goals. A paper called 'Challenges and opportunities for evaluating environmental education programs' (Carleton-Hug & Hug 2010) summarizes recent environmental education literature and offers opportunities for increasing the quality of evaluation in EE. Carleton-Hug and Hug's study examines information presented in EE evaluations published from 1994 to 2008 in several EE journals and the authors own experience. They point out the need of high quality systematic evaluation. As a tool to face the gap in systematic EE evaluation within conservation projects, the so called Adaptive Management (AM) was presented (CMP 2007). AM is a strategy to learn how to do conservation better through the use of formative research, and project monitoring. Following Conservation Measures Partnership (CMP) organisation's guidelines Open Standards for the Practice of Conservation, evaluation is designed into the five-step programme cycle where the

monitoring, its analyses and implementation to further practice is included (CMP 2007). Nevertheless there were only few examples of AM implementation within the conservation organisations up to 2010 (Jenks et al. 2010). In favour of improving environmental education standards, the Guidelines for Excellence in EE (NAAEE 2008) were put together by The North American Association for Environmental Education (NAAE 2014) and are nowadays seen as conservation education standards not only by American researchers.

An important review of environmental education evaluation was put together by Heimlich (2010) who found that most of so far published data on EE evaluation reveal lack of good foundations. He particularly raises objections against pre/post-measures only, and suggests post-measures with a referential group instead. The justification lies in the fact that many environmental messages are not new to people exposed to education and the measurement can therefore only describe reinforcing, clarifying, and adding to the cumulative knowledge/awareness versus creating new knowledge. In this case he suggests that only post-measurement makes far more sense for environmental education programs. For adolescents Heimlich (2010) suggests post-test for reasons of natural personality development that are independent of education programs. Baruch-Mordo et al. (2011) raise objections against missing a referential group in conservation education studies.

Most African studies with qualitative evaluation of environmental education programmes emerged in Eastern Africa. For example Ali (2002) focused on Kenyan children's ideas about nature parks and wildlife. Johnson-Pynn and Johnson (2005) focused mainly on knowledge gained through an environmental education programme in Uganda. Kuhar et al. (2007) evaluated conservation education programmes also in Uganda. McDuff (2000) reviewed results of thirty years of wildlife clubs existence in Kenya. Nevertheless, none of those programmes intended to measure environmental attitudes by an established scale which would allow comparison with other studies.

Three articles used the two most used scales of environmental attitudes the Two Major Environmental Values (2-MEV) model (Bogner & Wiseman 1999) and New Environmental Paradigm (NEP) scale (Dunlap et al. 2000). Boerchers et al. (2014) evaluated effectiveness of long duration environmental education extracurricular activities in Ivory Coast. Ogunbode and Arnold (2012) employed NEP scale to examine environmental attitudes of university students in Nigeria. Van Petegem and Blicek (2006) employed NEP scale for children in Zimbabwe and compare results with Belgian children. Only the first mentioned article used an established environmental attitude scale to assess effectiveness of education programmes.

Not many studies have been published on the evaluation of outdoor EE effectiveness worldwide (Bogner & Wiseman 2004; Kossack & Bogner 2012; Liefländer et al. 2013; Fremerey & Bogner 2015). No comparative study has been published on effectivity of outdoor excursions within conservation programmes in developing countries so far.

## **2.5. Measuring environmental attitudes**

Since 1970s, attempts have been made to develop a scale that will be able to measure people's environmental attitudes. This is when the Ecology Scale (Maloney & Ward 1973), Environmental Concern Scale (Weigel & Weigel 1978) or New Environmental Paradigm (NEP) scale (Dunlap & Van Liere 1978) first appeared.

In 1995, Leeming et al. (1995) pointed out that although many scales have been used to measure environmental attitudes, none was validated for a general use. Thus the field was open for a new research and environmental attitudes scale development. Aware of that, many researchers turned their attention toward missing evaluation tools for EE and have been enriching the evaluation tool box (Bogner & Wiseman 1999; Bogner & Wiseman 2002; Bogner & Wiseman 2004; Bogner and Wiseman 2006; Roczen et al. 2014; Powell et al. 2006).

Today, the two most widely used measures of environmental beliefs are the Two Major Environmental Values (2-MEV) model (Bogner & Wiseman 1999) and New Environmental Paradigm (NEP) scale (Dunlap et al. 2000). The 2-MEV was created in 1999 and after seven years of 'fine tuning', confirmation in different environments (Bogner & Wiseman 1997) and by different research teams (Milfont & Duckitt 2004), the authors were sure of its validity (Bogner & Wiseman 2006). The 2- MEV scale places respondent's environmental attitudes within two higher order factors preservation and utilisation. Those two factors are independent and can be held concurrently.

The NEP on the other hand was created as unidimensional scale, where respondents' environmental attitudes are placed either within eco-centrism or anthropocentrism. The original NEP scale was created in 1978 (Dunlap & Van Liere 1978), it was majorly revised by its authors in 2000 (Dunlap et al. 2000). It was therefore between those two scales (2-MEV and NEP) that we made a choice in order to evaluate general environmental attitudes of Senegalese children and its change after exposure to education programme.

## **2.6. The New Environmental Paradigm scale**

The most important argument for finally choosing the NEP scale was the fact that its questions are formulated broadly enough, so it is applicable even in non-western societies (Milfont & Duckitt 2010) and its non-shortened version (15 items, Bogner & Wiseman 2006) has fewer questions than the original version of 2-MEV (20 items, Dunlap et al. 2000). The NEP scale measures whether the respondents' general environmental attitudes correspond more to an anthropocentric (concern for humans) than to an eco-centric (concern for all living things) world-view (Bamberg & Möser 2007; Manoli et al. 2007; Van Petegem & Blicck 2006). It has been used across cultures and continents (Chatterjee 2008; Corral-Verdugo & Armendariz 2000; Gangaas et al. 2015; Kopnina 2011; Schultz & Zelezny 1999; Wu 2012), while a simplified and rephrased version was developed for use with children (Manoli et al. 2007). The NEP scale has already proven its validity not only as an instant measure of environmental attitudes, but also as a tool to monitor changes in attitudes after exposure to education programmes, in both adults (Dunlap 2008), and children (Collado et al. 2013; Corraliza et al. 2013; Manoli et al. 2007; Wu 2012) .

Although the NEP was developed as unidimensional measure, later studies revealed distinct dimensions (subscales) that should be treated separately (Dunlap et al. 2000; Hawcroft & Milfont 2010). The number of subscales varies from two to four across studies (Dunlap et al. 2000; Dunlap 2008; Dunlap & Van Liere 1978). Based on the considerable inconsistency in the number and structure of its dimensions, the authors of the NEP encourage researchers to carry out factor analysis of their entire item set to determine its dimensions (Dunlap et al. 2000). In terms of dimensionality, the NEP authors also call to future researchers for gathering data from various demographic, cultural or social settings with the goal that one day, it will be possible to compare the coherence of NEP beliefs across nations (Dunlap et al. 2000).

## **2.7. Environmental attitudes across cultures**

It was found in previous studies, that even when the environmental attitude values seem to be comparable between western and non-western nations, it is possible that these values do not arise from the same psychological constructs. For example, according to Aoyagi-Usui et al. (2003) pro-environmental attitudes are based on altruistic values in the Western countries,

while in Asia pro-environmental attitudes result from traditional anthropocentric concerns that pragmatically lead to caring for the environment without necessarily adopting eco-centric motivations. This is why together with quantitative, the qualitative data should be collected when using the NEP scale (Corral-Verdugo & Armendariz 2000; Kopnina 2011; Kopnina 2012). Such data can reveal the motivations behind the respondents' answers and can eventually lead to the better phrasing of NEP items for different cultures.

Another source of discussion, especially as concerns non-Western countries appears to be the exclusiveness of the two dimensions of NEP scale. Hereby, respondents' attitudes are either anthropocentric or eco-centric, but not both (Manoli et al. 2019). This concept has been validated in western nations, but proved not to be applicable in some developing countries (Bechtel et al. 1999; Bechtel et al. 2006; Corral-Verdugo & Armendariz 2000; Ogunbode 2013; Van Petegem and Blicck 2006). For instance Ogunbode (2013) found that whilst Nigerians and Westerners agree that 'Humanity is subject to the laws of nature', only Nigerians, unlike Westerners, can respond in the same time positively to the statement that 'Humans will eventually learn enough about how nature works to be able to control it'. This seemingly contradictory answer might be based on the common belief that one can learn how to control the nature through spiritual empowerment, which is independent of technological advancement (Ogunbode 2013). Another example challenging the concept of dualism in Africa comes from the comparative study by Van Petegem and Blicck (2006), which showed that children from Zimbabwe simultaneously hold a pro-ecological worldview and feel dominant over nature, believing that they have the right to use nature for their needs. Corral-Verdugo and Armendariz (2000) found the same results in Mexico. In multicultural comparative studies, the dualistic view on the NEP was much more reported by the group of students from the United States than by the Mexican, Peruvian, and Japanese ones (Bechtel et al. 2006). There is, therefore, need to examine the validity of the NEP scale for children in a non-western nation setting by assessing the internal consistency of the scale and determining its dimensions. If dualistic answers occur, it is worth to ascertain the mental concepts behind the respondents' answers.

## 2.8. Western Derby eland conservation

The Derby eland (syn. Giant Eland, *Taurotragus derbianus*) is a large sized herbivore occupying the Guinea-Sudanian savannah woodland and wooded grassland. It is one of the largest antelopes of the planet. It is a majestic and almost mysterious animal and therefore carries a huge potential to become the flagship species that would contribute to conserve its natural habitat as a whole (Brandlová et al. 2013).

Two subspecies of Derby eland have been recognized: Eastern Derby Eland (*T. d. gigas*) and Western Derby Eland (*T. d. derbianus*). While the Eastern Derby Eland is considered vulnerable, the Western subspecies is listed as critically endangered (IUCN Red List 2017). The first really successful conservation ex-situ for the Western Derby Eland (WDE) started in 1999 and 2000 by capturing 9 animals from their last natural habitat Niokolo Koba National Park (NKNP) (Akakpo et al. 2004). The captures succeeded and reproduction started with 6 founders (1 male and 5 females) in the Bandia reserve (14°35'N, 17°00'W) in 2002 (Brandlová et al. 2013). Since that time, management of this semi-captive population brought many achievements and a second geographically separate population was established in the Fathala reserve (13°39'N; 16°27'W) the main terrestrial part of the Delta du Saloum National Park on the south-west of Senegal (Brandlová et al. 2013). The semi-captive breeding population with a total number of 115 animals in 2018 (Brandlová et al. 2018) represents the gene pool for future conservation of the subspecies and potentially for the reinforcement of the wild population (Brandlová et al. 2013). The semi-captive breeding population provides not only a gene pool and a stock of animals, but also a unique tool for fundraising and public awareness activities towards its natural habitat of the both reserves and unique ecosystem of NKNP which is listed as a World Heritage Site in Danger (UNESCO 2015) with the remaining wild WDE population estimated below 200 individuals (Renaud et al. 2006).

## 2.9. Beginning of Western Derby eland conservation education activities in Senegal

The primary condition for a successful conservation of a species is ensuring the sustainable protection of the species' natural habitat. Nature has been under increasing pressure in Senegal as the country's population increased from 10 million inhabitants in 2000 to 15 million in 2015 (WB 2016). With this significant population increase, it is apparent that citizens' attitudes toward nature are becoming even more important than they were in the past. These attitudes determine the way people in Senegal approach the environment now and how

they will approach it in the future. To influence future attitudes towards nature conservation, we first need to map current attitudes.

The wild population of Western Derby eland is threatened mainly by habitat loss caused by human activities. The list of threats includes: habitat loss and fragmentation due to industrial and agricultural activities; cattle grazing within the natural habitat of the WDE; poaching; ineffective law enforcement and inadequate application of the management plan of the protected area; lack of involvement of local communities in management of NKNP; insufficient awareness of local populations; potential genetic depletion in the natural population (Brandlová et al. 2013).

Experience during the capture operations in 2000 in the Niokolo Koba National Park showed lack of understanding of conservation action within local population resulting from insufficient communication of conservation goals (pers. comm. Paul Ndiaye 2002). In the Delta du Saloum NP in the south west of Senegal, the local inhabitants also opposed fence erection for establishing the Fathala reserve in 2000 and repeatedly later (pers comm. Pavla Hejzmanová 2009). This confirms that no conservation effort can efficiently work without considering local population (Andrade 2004; Infield & Namara 2001; Kellert 1996) and justifies insufficient awareness of local populations and lack of involvement of local communities in management of NKNP, to be sound points on the list of threats to Western Derby eland populations (Brandlová et al. 2013).

As to face some of above mentioned threats, the Czech University of Life Sciences in Prague (CULS) launched a series of environmental educational programs for schoolchildren from villages surrounding the Fathala reserve and Delta du Saloum NP in 2008. A set of educational tools (memory game, story-telling cards, posters, leaflets and activities) was developed. Small textbook 'Protegeons notre nature!' (Koláčková et al. 2008) was prepared by team members and distributed amongst all participating children. Environmental education exposition (Figure 1) was constructed within the Czech Development Aid Cooperation. The centre serves for educational purposes to both locals and visitors. A small shop with local and promotional products was set next to the exposition and aimed to strengthen the locals' income (CSAW 2010).

Alongside programs for children, the locals and reserve/park staff from the villages surrounding the Fathala reserve and the Delta du Saloum NP went through workshops and community celebration were organised inside Fathala reserve (pers. comm. Pavla Hejzmanová). These programs were oriented on the importance, necessity and advantages of



nature protection and sustainable natural resources utilization, and extended to topics regarding wildlife breeding and ecotourism. Programs continued in 2009 and additionally, more than 130 adults went through them (CSAW 2010).

In 2008, Society for the Protection of Environment and Fauna of Senegal (SPEFS) with support of the CULS has started massive promotion of the Fathala reserve to attract more tourists to the area. SPEFS contacted several tourist agencies from Senegal and Gambia and CULS developed promotional leaflets. An educational and research centre in the Fathala reserve was constructed by CULS together with SPEFS in 2009. The centre is supposed to serve as the base for national and international researchers during their research activities in the reserve and to enable educational programs for locals from more distant areas (CSAW 2010). The potential objective of the research centre has not been fulfilled as the management of the Fathala reserve assigned another function to the building (pers. observation). Since then, a luxury lodge and restaurant were built and ecotourism grows in the area, especially under the new South African management.



Figure 1. Educational exposition in Fathala reserve, source: Derbianus Conservation z.s.

## 2.10. Social and educational settings of Senegal

Senegal is the westernmost country on the African continent (Figure 2) and covers a total of 196,722 sq km (CIA 2019). The population is concentrated alongside the west coast. Up to half of 15.4 million people living in Senegal (last census 2016, World Bank 2019) is concentrated around the capital city Dakar and other urban areas. 95.9% of Senegalese are Muslim and 4.1% Christian. Ethnicity is pronounced in Senegalese society with most people belonging to Wolof ethnic (37.1%). Pulaar with 26.2% and Serer with 17% of population follow. Mandinkas (5.6%), Jolas (4.5%) and Soninkes (1.4%) are rather minorities. Other 8.3% account for Europeans and persons with Lebanese origins (2017 est. CIA 2019). According to the last estimate from 2017 the ability to read and write at age 15 is shared within 51.9% population. The official language of Senegal is French, but also ethnic languages are spoken (Wolof, Pular, Jola etc.). In 2018 urban population accounted of 47.2% of total population with a rate of 3.73% annual increase (2015-20 est. CIA 2019).

Senegal is the second fastest growing economy in West Africa, the poverty however affects 46.7% of the population. Geographic disparities are very pronounced with almost twice as much residents considered poor in rural areas, than in capital city Dakar (WB 2016). The education system is based on its French counterpart, when primary education is obligatory and free of charge. Primary education is divided into three cycles of two years (WB 2017). In 2015, 82% children of official primary education age enrolled to primary school. This number includes a significant number of youth who only go to Koranic schools that are not aligned with the public curriculum. Only 58% of enrolled children eventually reached the last grade in 2014 (WB 2017).

### 3. AIMS OF THE THESIS

This thesis aimed to investigate the potential of environmental education activities to support nature conservation in Western Africa. To achieve the aim, three particular aspects of evaluation of environmental education programmes were investigated in following separate case studies:

#### **3.1. Environmental education supports conservation action by increasing the immediate and long-term environmental knowledge of children in West Africa**

The objective of this study was to test whether environmental education programmes in Fathala reserve, Senegal had desired impact on targeted children. We tested whether (a) environmental knowledge will increase after the education programme and attitudes will shift positively towards nature protection; (b) environmental knowledge and attitudes gained within the environmental education programme will be retained in the long-term horizon. To understand better variables of education process we also questioned whether (c) the age and gender of respondents will influence their environmental knowledge.

#### **3.2. Reliability of the new environmental paradigm for analysing the environmental attitudes of Senegalese pupils in the context of conservation education projects**

The aim of this study was to test broadly used measure of environmental attitudes in western nations and therefore to examine the validity of the New Environmental Paradigm scale for children in Senegalese settings. We assessed the internal consistency of the scale and determined its dimensions. We also focused on the occurrence of dualistic answers and tried to ascertain the mental concepts behind the respondents' answers. Specifically, the study seeks to answer following research questions: (a) What is the validity, reliability, and structure of the NEP scale when applied on Senegalese children? ; (b) How Senegalese children interpret the meaning of the NEP items and what mental concepts their interpretation reflects?

### **3.3. Do Short-duration Environmental Education Programmes and One-day Excursions Influence Senegalese Primary Schoolchildren's Environmental Attitudes? Save Your Money and Stay in the Classroom.**

In the last study of this thesis we evaluated the impact of an environmental education programme on children's environmental attitudes. In this purpose we used results from previous study about applicability of broadly used New Environmental Paradigm scale for children in Western countries in Senegalese settings. We evaluated environmental education programmes set up in the two Senegalese administrative regions of Dakar and Thiès in 2015 as part of the Western Derby eland conservation intervention strategy. Moreover, we aimed to assess the effectiveness of an outdoor excursion in influencing children's attitudes towards nature protection; and role of socio-economic factors on children's environmental attitudes and their potential to be changed.

## 4. MATERIALS AND METHODS

The research has been conducted within the Western Derby eland conservation programme and in accordance of the Western Derby Eland Conservation Strategy (Brandlová et al. 2013).

### 4.1. Study area

The data were collected in two phases involving different geographic locations within Senegal: 1) 2008-2009 Fatick administrative region of Foundiougne department; 2) 2015-2016 Bignona administrative region of Ziguinchor department, Dakar, Pikine and Rufisque regions of Dakar department and Mbour region in Thiès department (Figure 2).

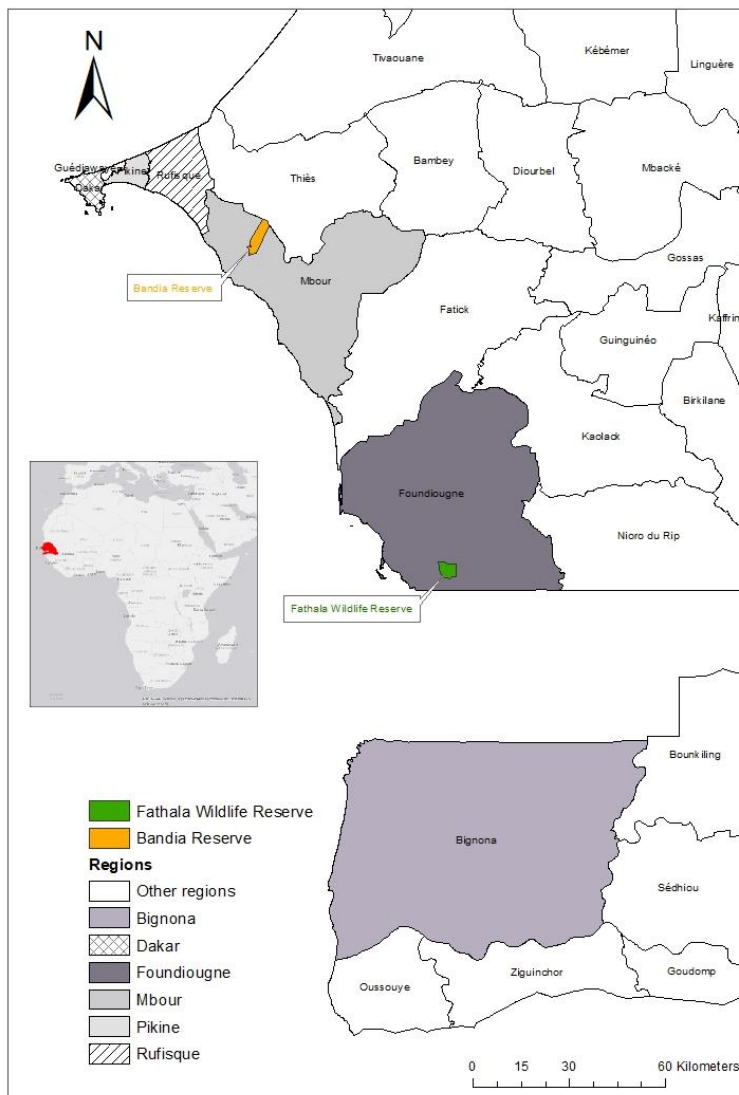


Figure 2. Study area, regions where data collection took part are highlighted, (Author: Zuzana Holubová)

## **Fathala reserve**

Fathala reserve (N13° 38' 27.7794'; W16° 25' 50.2572') is a fenced terrestrial section of the Delta du Saloum National Park and Biosphere reserve in Senegal, and its surroundings. The Fathala reserve is a privately managed game reserve (CSAW 2010). Since 2002 the area has been accessible to tourists. One of the priorities in the Fathala reserve has been the Western Derby eland Conservation programme (Brandlová et al. 2013), which has contributed substantially to the development of ecotourism in the whole area.

## **Bandia reserve**

The Bandia reserve is the first working enclosed breeding site for large animals in Senegal and the adjacent states, led by the Society for the Protection of the Environment and Wildlife in Senegal (Société pour la Protection de l'Environnement et de la Faune au Sénégal - SPEFS). The Bandia reserve lies 65 km east of Dakar (14°35'N, 17°00'W), on the south west border of 'Forêt classée de Bandia'. The Bandia reserve was established in 1990 on an economically exploited and markedly degraded baobab grove (CSAW 2010).

## **4.2. Target group**

### ***4.2.1. Target group 2008-2009***

Our target group were children attending local state elementary schools in grades CE1 (elementary course first year), CE2 (elementary course second year), CM1 (intermediate course first year), and CM2 (intermediate course second year) (Senegal 2010). The age of our target group (grade CE1–CM2) was therefore expected to be within 8–12 years. A few exceptional age deviations were found in our questionnaires and the subjects' actual age ranged from 8 to 17 years, probably due to delayed start of primary education or multiple doubling of school grades (e.g. Montgomery & Hewett 2005). In total 350 children were involved in study as they filled both pre- and post- questionnaires. Out of these children, 144 accounted for females and 205 for males, one participant did not mention his/her gender.

### ***4.2.2. Target group 2015-2016***

Out of 765 questionnaires collected in pre-study, 448 accounted for respondents from urban areas (229 female respondents, 219 male respondents) and 317 for rural areas' respondents (145 female respondents and 172 male respondents). Participants consisted of

CM1-level (lower secondary) schoolchildren. CM1 school grade corresponds with the first level of the so-called ‘middle school’ in Senegal, and thus theoretically comprises children in the 12-13 year age group. In our case, the average age of participating children was 13 (ranging from 10 to 16, with one exception of 17 and two who were 18 years old). This deviation in age from what is norm was caused either by a delayed start in primary education, or by multiple class repetitions.

In post-study, we monitored 303 children: 151 male respondents and 149 female respondents (three children did not mention their gender). Of these, 157 children attended urban schools, and 146 rural schools. Overall, 135 children participated in a two-day, in-class programme, whereas 168 took a one-day in-class programme, visiting the Bandia natural reserve the second day. Most respondents belonged to either of 5 ethnic groups: Serer (n=100), Wolof (36), Toucouleur (9), Mandingue (7), and Fulani (7), with the remaining ethnic groups forming the ‘minority’ category.

Overview of participating schools in all programme years sorted by regions is provided in Table 1.

Table 1. Overview of schools involved in the study with year of participation and testing scheme (post-test YES/ NO). Programme column stands for participation in education programme either in 2008-2009 or 2015-2016.

school/ village	region	year of participation	post-test	programme
Bakadaji	Foundiougne	2008-2009	YES	YES
Boutilimid	Foundiougne	2008-2009	YES	YES
Dassilamé Socé	Foundiougne	2008-2009	YES	YES
Haidara	Foundiougne	2008-2009	YES	YES
Kaolack	Foundiougne	2008-2009	YES	YES
Karang	Foundiougne	2008-2009	YES	YES
Karantaba	Foundiougne	2008-2009	YES	YES
Keur Sagnang	Foundiougne	2008-2009	YES	YES
Missirah	Foundiougne	2008-2009	YES	YES
Samé	Foundiougne	2008-2009	YES	YES
Saroudia	Foundiougne	2008-2009	YES	YES
Taiba	Foundiougne	2008-2009	YES	YES
College du Cathedral	Dakar	2015-2016	YES	YES
Notre damme du Liban	Dakar	2015-2016	YES	YES
Groupe Scolaire Thiass/ Malika	Pikine	2015	YES	YES
Rufisque CEM Arafat II	Rufisque	2015-2016	YES	YES
village Daga	Mbour	2015-2016	YES	YES
Yadicone Nguekokh	Mbour	2015-2016	YES	YES
Joal	Mbour	2015	YES	NO
CEM Mbour	Mbour	2015	YES	NO
Tene Toubab	Mbour	2015-2016	YES	YES
CEM Sessene	Mbour	2015-2016	YES	YES
CEM Mbour Serere	Mbour	2015	NO	NO
CEM Mbaling	Bignona	2015	NO	NO
CEM Badioure	Bignona	2015	NO	NO
CEM de Mangoulene	Bignona	2015	NO	NO
CEM Tandieme	Bignona	2015	NO	NO
CEM Ahoune Sane	Bignona	2015	NO	NO
Lycee Tenghory Arrondissement	Bignona	2015	NO	NO
Arfang Bessire Sonko	Bignona	2015	NO	NO



### 4.3. Content of education programmes

#### 4.3.1. 2008-2009

The education programme for local elementary school children was performed in two steps, theoretical and practical. Frontal education sessions were held in newly built environmental education centre, ‘interconnections game’ was employed and programme in the centre was followed up by guided safari in the reserve. The programs were repeated in 2008 and 2009. The content of environmental education programme was presented in following topics is therefore following: 1. Protected areas in Africa, Senegal and Czech Republic comparison of two countries in measures of inhabitants number, size and protected area relative cover, 2. human-wildlife equilibrium, 3. useful plants, 4. wildlife in Senegal, extinct animals in Senegal, 5. Water cycle, how to manage fire, 6. the importance of school, 7. garbage, 8. pastures, fields and countryside, 8. domestic animals, 9. ecotourism, 10. nature protection in Senegal.

#### 4.3.2. 2015-2016

Children were exposed to environmental education programme of total duration from 7 to 8 contact hours. Lectures were provided by one Senegalese and one foreign educator in French language. The lecturers used verbal, demonstration and practical-work methods to engage participating schoolchildren (Janiš et al. 2008). First programme day began with a discussion on elements of the natural world and their connectedness (Figure 3). A game was included whereby children representing elements in the environment, such as grass, water, fly or lion, end-up mutually connected with a rope, demonstrating these interrelations in nature.



Figure 3. Children from CEM Dagga from right a) during ‘story telling cards’ group activity, b) performing ‘interconnections game’.

Theoretical part of programme consisted of presentation of the following topics: causes of loss of species (poaching, deforestation, and human encroachment), soil degradation, bush fires; examples of extinct species in Senegal; protected areas in Senegal and their role; the Western Derby eland as a flagship species of the Senegalese natural environment and threats to the eland's survival. Theoretical classes were illustrated by visual material projected on the classroom wall (Figure 4) and children were encouraged to actively participate and respond to questions about the threats to nature in Senegal.



Figure 4. Children from CEM Sessen during theoretical part of the education programme

At the end of the first day, children were asked to build up a story using Derby eland conservation team author story-telling cards showing different forms of unsustainable nature use in Senegal (Figure 3). Groups of children working together then showed their chosen cards in chosen order and told their story either to the lecturer or their teacher, whoever was available. During the second day, nature and wildlife in Senegal was presented using photographs of animals and trees projected on the lecture room wall with the 'Class-group'.

The ‘Reserve-group’ observed the same animals during an outdoor excursion in the Bandia reserve. Children from both groups were given a species check-list and were asked to mark all the animals they saw on photographs or in the reserve. Children collected points for every animal identified. For identification they used a booklet designed by the education team ‘*Les animaux du Sénégal*’ (Figure 6).

‘Class-group’ and ‘Reserve-group’ children were provided with the same information and participated in the same activities, only the setting (and type of exposure to stimuli) differed (Figure 5).



Figure 5. Comparison of second day of programme of ‘Class-group’ and ‘Reserve-group’



Figure 6. Booklets developed by the author of thesis for environmental education programs in Senegal

#### 4.4. Questionnaire

##### 4.4.1. Questionnaire 2008-2009

Questionnaire in 2008 and 2009 consisted of seven open-ended questions. Four of them (Q1: Write the names of four wild animals living in Senegal; Q2: Write the names of protected areas you know in Senegal; Q3: What endangered animals live in Fathala reserve; Q7: Where do we put the garbage?) focused on local environmental knowledge; and three questions (Q4: Why is it important to protect nature?; Q5: Why is it important to keep some animals in nature reserves?; Q6: Is it good to have a forest near the village? Why?) investigated attitudes toward environmental problems directly related to the area where the respondents live. Although the increase in conservation related knowledge was recorded, later findings revealed lack of systematic measure for environmental attitudes (Carleton-Hug & Hug 2010; Koprina 2011) and the new questionnaire was therefore administered in 2015 and 2016.

##### 4.4.2. Questionnaire 2015-2016

In study which tested reliability of NEP scale in Senegalese settings, we used A 10-item version of the NEP Scale for Children (Manoli et al. 2007) to measure general environmental attitudes (Table 10). The items 1-10 were translated into French. To eliminate misunderstanding of the wording, we interviewed children (n=10) and discussed our preliminary version of the questionnaire with local teachers (n=3). The teacher discussion led us to change in item 5 and 10; there was considerable misunderstanding of the phrase ‘to mess up nature’, so we were advised to translate it literally as ‘to make a mess in nature’. Item 10 was rephrased in French to promote understanding without changing meaning: ‘Nous serons en danger si nous continuons à détruire la nature et nous risquons la catastrophe’ was used instead of ‘Si les choses ne changent pas, nous aurons une grande catastrophe dans l’environnement.’ Basic respondent demographic data were collected in the header of the questionnaire.

The scale consists of six eco-centric questions (concern for all living things; questions 1, 2, 4, 5 and 8; e.g. Q1 ‘Plants and animals have as much rights as people to live’), and four anthropocentric questions (concern for humans/utilitarian view on nature: e.g. Q7 ‘People are supposed to rule over nature’, questions 3, 6, 7 and 9). To test specific conservation attitudes relevant to Western Derby eland conservation, we designed an additional set of four questions (questions 11-14; see Table 11). Questions 15-18 were appended in order to test children’s specific knowledge related to nature and its conservation in Senegal. Q15 ‘Which silhouette is

of the Derby eland', which included drawings of animal silhouettes, Q16 'Name 10 wild animal species occurring in Senegal', Q17 'Over what time duration does a plastic bag decompose?', and Q18 'Name 5 Senegalese nature reserves'. In overall, questions 1-14 were administered as a choice from a five-point Likert scale, graded from strongly agree (1) to strongly disagree (5) with value (3) meaning 'I am not sure', and questions 15-18 as single-choice and open-ended questions.

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#### **4.5.Data collection and analyses**

##### *4.5.1 Environmental education supports conservation action by increasing the immediate and long-term environmental knowledge of children in West Africa*

To investigate the impact of our EE on respondents' actual knowledge and attitudes, we evaluated two main points: i) the shift in knowledge and attitudes after the training and ii) the long-term (one-year) retention of the knowledge gained during the education programme.

Questions Q1, Q2 and Q3 were scored according to number of points, so the shift in knowledge before and after the programme could be evaluated. The numbers of points in the questions were square root transformed in order to meet assumptions for use of the parametric test. To test differences in the number of points obtained for each question, we used Student's paired t-test. In order to evaluate the answers to Q7, we applied contingency tables.

We often encountered the expression 'biche' within wild Senegalese animals. 'Biche' is a word that comprises all antelopes in most widespread Senegalese language (Wolof) and it was counted as one correct point. Domestic animals that appeared within answers, including cow, goat and sheep were not accepted whereas cat and dog were considered correct because wild cats and wild dogs occur in the area.

The effect of the age and gender of the respondents on their environmental knowledge was evaluated for Q1, Q2 and Q3 together by summing the number of points obtained by the respondents in these questions. The sum of points had a normal distribution (tested by the Kolmogorov-Smirnov test). The effect of age was tested by simple linear regression for all children together and then for males and females separately. The effect of gender was tested by analysis of co-variance (ANCOVA), with the total number of obtained points as dependent variable, gender (male, female) as a categorical predictor and age as a continuous independent co-variable.

Three questions concerning environmental attitudes (Q4-Q6) implied answers of a categorical character and had to be classified into generalised groups. Q4 was rated YES for at least one reason why nature should be protected and NO for a meaningless reason. In Q5 the answers were consequently divided into two groups: a) animals are dangerous, b) animals are endangered. Responses to Q6 were divided into two main groups: a) forest seen positively (YES), b) forest seen negatively (NO).

In order to evaluate the long-term persistence of the education programme on the environmental knowledge of the children, we tested differences in the total numbers of points obtained in Q1, Q2 and Q3 from the pre-questionnaires in the first year (pre-2008), post-questionnaires in the first year (post-2008) and pre-questionnaires of the second year (pre-2009) in 41 children who participated in the education programme in both years. These differences were tested by repeated measures analysis of variance with the total number of points as dependent variable and the three types of questionnaire as independent within effect predictors. This test was followed by post-hoc HSD Tukey test to reveal significant differences in the total number of points.

#### *4.5.2. Reliability of the new environmental paradigm for analysing the environmental attitudes of Senegalese pupils in the context of conservation education projects*

Originally, the NEP scale was designed for children of 10-12 (Manoli et al., 2007), but based on previous experience with environmental education programmes in Senegal, where younger children had difficulties writing in French, we found it more suitable to apply the scale on older children. The scale was therefore administered to 12-14 year old children.

Qualitative data were gathered by interviewing two mixed groups in two schools (n=10, n=7) using each scale item to reveal the mental concepts behind the children's answers. The responses of each group were recorded individually. The same criterion for participation was applied for the interview groups as for the 'questionnaire group'. The sample was selected on a voluntary basis and included children who did not participate in the educational programme. Ten male and seven female respondents ranging in age from 12 to 14 years participated in two mixed-gender interview groups.



Figure 7. Author distributing and collecting questionnaires in CEM Sessen

The NEP scale measures whether respondents' environmental attitudes correspond more to an anthropocentric (low NEP scores) or an eco-centric worldview (high NEP scores), with a value of 3.00 used as the boundary (Bamberg & Möser, 2007; Manoli et al., 2007; Van Petegem & Blicek, 2006). As the Likert scale for children was graded from strongly agree (value 1) to strongly disagree (value 5) in our case, it was reversed for further statistics to ensure comparability with similar studies.

The confirmatory factor analysis (CFA) was performed to evaluate the extent to which the obtained data correspond to hypothetical NEP structure (Byrne 2010; Dunlap et al. 2000; Manoli et al. 2007; Schumacker & Lomax 2004). The consistency of the following three subscales (Dunlap et al. 2000; Manoli et al. 2007) was examined: Rights of Nature (items 7, 1, 4), Eco-Crisis (items 10, 2, 8, 5), Human Exceptionalism (items 3, 6, 9). Furthermore, the internal consistency of the scale as both a single and a multidimensional measure was analysed by the Cronbach alpha test (Tavakol & Dennick 2011). Principal component analysis was used to reveal the different potential dimensions (subscales) specific to this dataset.

Quantitative data (obtained scores for individual items 1 - 10) were transformed by Box-Cox transformation ( $\lambda=1.119$ ) to improve the normality of distribution (tested by Kolmogorov-Smirnov test of normality). Two-way ANOVAs were used to test the effects of gender, socio-economic background and their interaction on obtained scores for each item separately. Significant differences were tested by post hoc Tukey tests. The effect of age on scores (Box-Cox transformed) was tested using Pearson's correlation. Analyses were performed using the Statistica 13.2 package (StatSoft, Tulsa).

#### *4.5.3. Do Short-duration Environmental Education Programmes and One-day Excursions Influence Senegalese Primary Schoolchildren's Environmental Attitudes? Save Your Money and Stay in the Classroom.*

As the 10-item NEP Scale for Children proved to be inconsistent as a whole or in other studies coherent clusters (Van Petegem & Blicek 2006; Manoli et al. 2007; Ogunbode 2013) when used on a corresponding sample (n= 782) of Senegalese children (Grunova et al. 2018), we evaluated the responses question by question.

Respondents were sampled using a pre-, post-, and long-term design (e.g. Barch et al. 2007), i.e. the same questionnaire was administered to the same children before the programme, three weeks after the programme and one year after the programme (Figure 7). The NEP score was calculated as the sum of positive responses in the eco-centric questions and as a sum of negative responses in the anthropocentric questions to allow comparison of our results with those of similar studies. The same was done with questions on specific conservation attitudes (Q11-14).

To explore the influence of socio-economic factors on children's knowledge, and attitudes towards the environment before the intervention, we tested the effects of school location (urban, rural), father's employment status (in the categories agriculture, labourer, or jobs requiring higher formal education), and respondent's ethnic origins (Mandingue, Fulani, Wolof, Serer, Toucouleur, and 'other') via a Repeated Measures ANOVA (Davidian & Giltinan 1995) for each effect separately.

The programme's effect on children in general, its effect on children from urban/rural schools, and on the participants of two forms of the programme (in-class / outdoor excursion) was tested with the total number of knowledge points defined as sum of points appointed to correctly answered Q15-18, or Likert scale values in the post-test as dependent, and school location or form of programme as independent variables. Tukey's HSD tests were applied to



test significant differences in all the repeated measure ANOVAs as it applies simultaneously to the set of all compared values.

In order to test correlations between total knowledge and attitude scores, we used Spearman's rank correlation. To test the probability that knowledgeable children, i.e. children with high knowledge scores will name the Western Derby eland in the post-test within wild animals occurring in Senegal, we used logistic regression with the number of correctly listed animals in question 16 as a dependent variable and the total knowledge score as an independent variable. All statistical analyses were carried out using the STATISTICA 13 package (TIBCO).

## 5. RESULTS

### 5.1. Environmental education supports conservation action by increasing the immediate and long-term environmental knowledge of children in West Africa

Citation: Grúňová M, Brandlová K, Svitálek J, Hejčmanová, P. 2017. *Environmental education supports conservation action by increasing the immediate and long-term environmental knowledge of children in West Africa. Applied Environmental Education & Communication 16(1): 3-16.*

Whole article in annexe 9.1.

#### 5.1.1. Environmental knowledge before and after the education programme

The number of stated Senegalese animals, Senegalese protected areas and endangered species living in the reserve reported by children in the questionnaires increased significantly

after the environmental education programme (all  $P < 0.05$ ). Responding children specifically stated correctly 2.8 animals before (ranging from 0 to 5 animals, median=3) and 3.5 after the programme (ranging from 0 to 9, median 4). On average, 1.12 reserves (ranging from 0 to 6, median=1) were named before and 1.80 reserves (ranging from 0 to 7, median=2) after the programme. On average, 0.77 endangered species (ranging from 0 to 3, median=1) were stated before and 1.17 after the programme (ranging from 0 to 5, median=1). The percentage of respondents who stated Derby eland within endangered species increased ( $\chi^2=86.6$ ,  $df=1$ ,  $P < 0.001$ ) after the education programme by 11 % (Figure 8a).

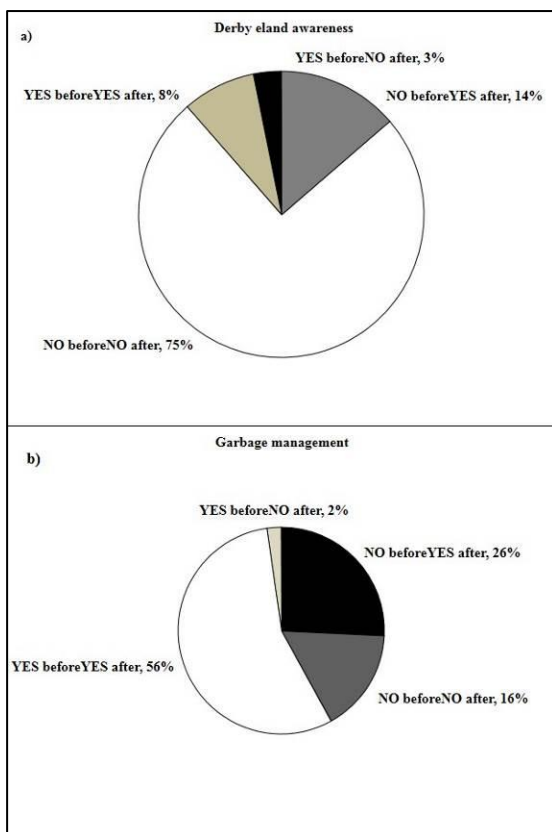
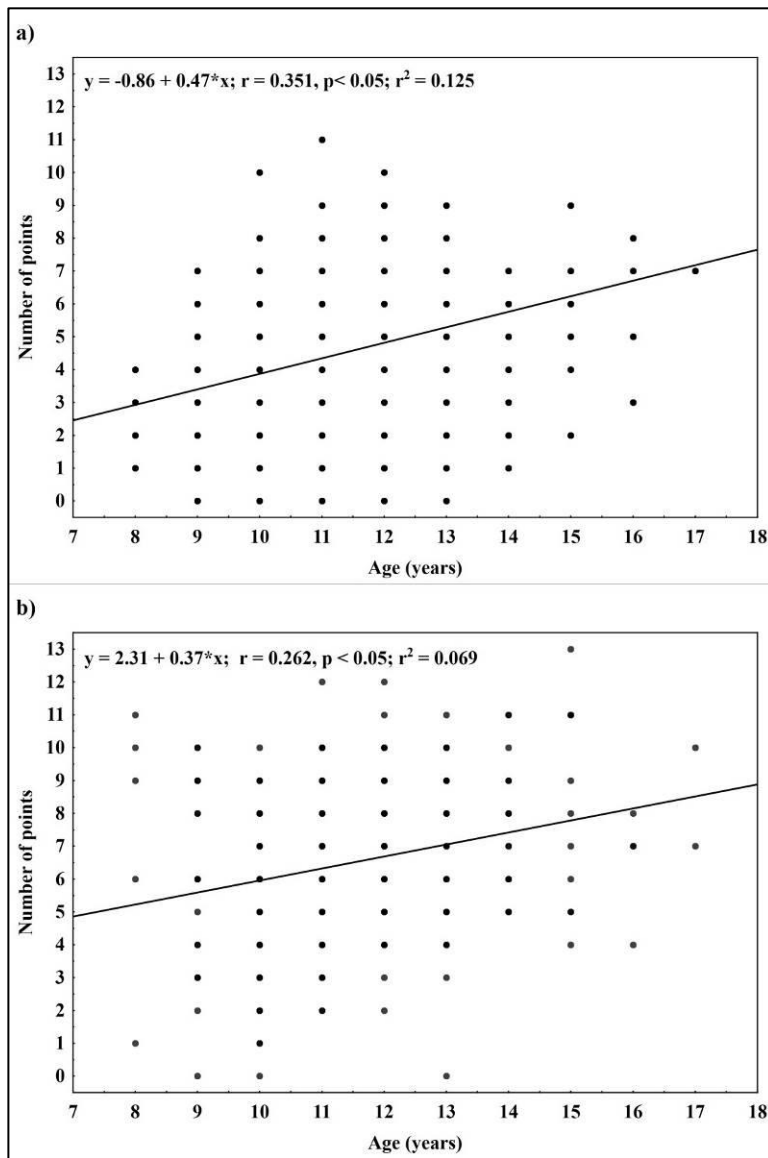


Figure 8. Percentage of respondents' aware a) of the occurrence of the critically endangered Western Derby eland in the Fathala reserve in the neighbourhood, and b) of environmentally appropriate/ acceptable garbage management, both before and after the education program.

The percentage of respondents who answered meaningfully where to put garbage increased by 24% ( $\chi^2 = 51.7$ ,  $df = 1$ ,  $P < 0.001$ ) after the education (Figure 8b). Among answers considered as meaningful were 'into the pit'; 'into the dust bin'; 'at the dumpsite'. Incorrect answers were, for instance, 'into the forest'; 'near/in the water well', 'in the village'; 'to the sea'.

Total numbers of points gained before and after the education programme were both

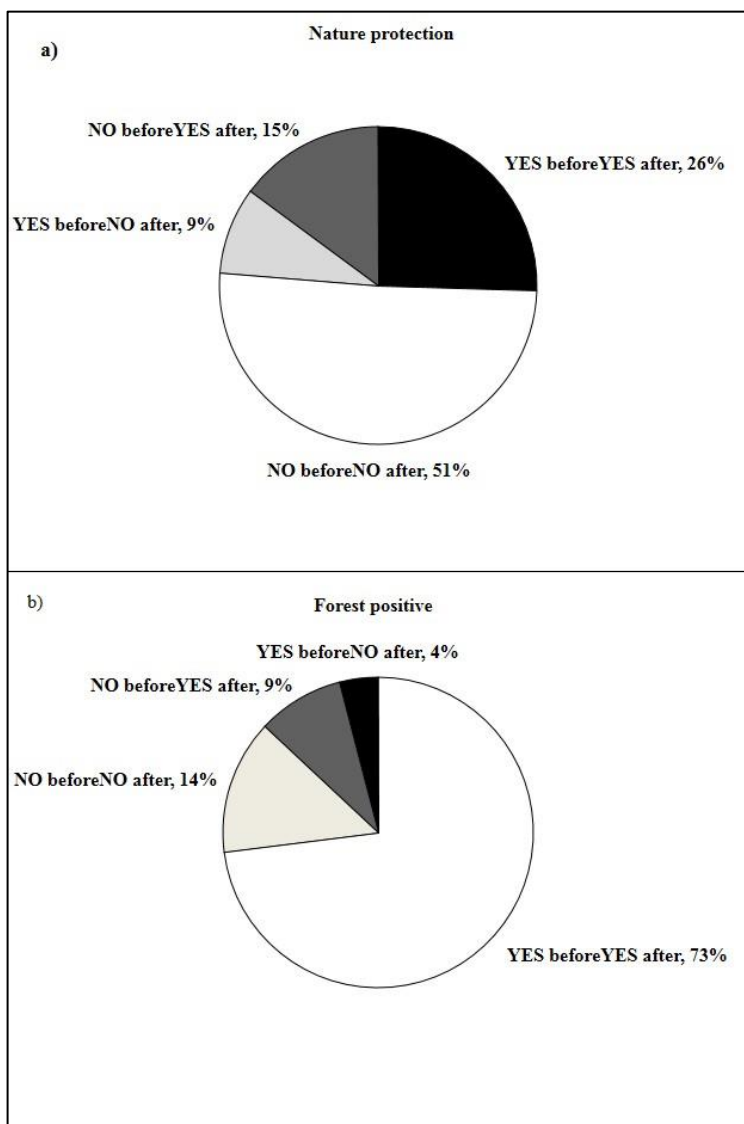


positively related to the age of the respondents (before:  $r = 0.35$ ,  $P < 0.001$ ; after:  $r = 0.26$ ,  $P < 0.001$ ); however, before the education respondents who were aged 1 year apart from one another differed by 0.47 points and after the education this difference decreased to 0.36 points (Figure 9).

Figure 9. Effect of the age of the respondents on the number of points gained in a) pre- and b) post-questionnaire

Before the education programme, male respondents gained, on average, 4.3 points (ranging from 2 to 8, median 4) in total for questions Q1–Q3 while females gained an average of 4.2 points (ranging from 1 to 8, median 4) ( $F=13.0$ ,  $P < 0.001$ ). After the education programme, there was no significant difference between males and females in gained points ( $F = 0.85$ ,  $P = 0.35$ ), with males and females gaining, respectively, an average of 7 (ranging from 3 to 13, median 7) and 6.8 (ranging from 0 to 13, median 6.5) points.

### 5.1.2. Environmental attitudes before and after the education programme



The number of respondents who stated a relevant reason for the importance of nature protection increased after the environmental education programme by 6%. The shift in attitude was significant ( $\chi^2 = 86.6$ ,  $df = 1$ ,  $P < 0.05$ , Figure 10). Frequent relevant answers were, for instance, ‘so that people do not kill the animals’, ‘so that the forest is preserved’ and ‘so that water resources are preserved’.

Figure 10. Percentage of respondents who claimed a) the importance of nature, and b) the presence of forest near their village as positive protection, both before and after the education programme in the Fathala reserve

The percentage of respondents who perceived forest positively before the course diminished after the course by 5% ( $\chi^2 = 111.1$ ,  $df = 1$ ,  $P < 0.05$ ). Common answers were ‘because animals and plants occur there’, ‘because it brings us water’.

Most of the respondents had various explanations for the importance of animals being in reserves such as ‘because there is vegetation’; ‘so that people can better see them’, etc. Two consistent groups of opinions appeared. They stated that animals were in reserves in order to be protected (21% of respondents) or because they were dangerous (9% of respondents). Whereas 9% of respondents changed their opinion after the education and stated

that the importance lay in protection rather than in the dangerousness of the animals, another 9% went the other way around ( $\chi^2 = 14.9$ ,  $df = 1$ ,  $P < 0.05$ ; Figure 11) and the final percentage of respondents explaining the importance of animals being in reserves ‘because they are dangerous’ remained the same before and after the education.

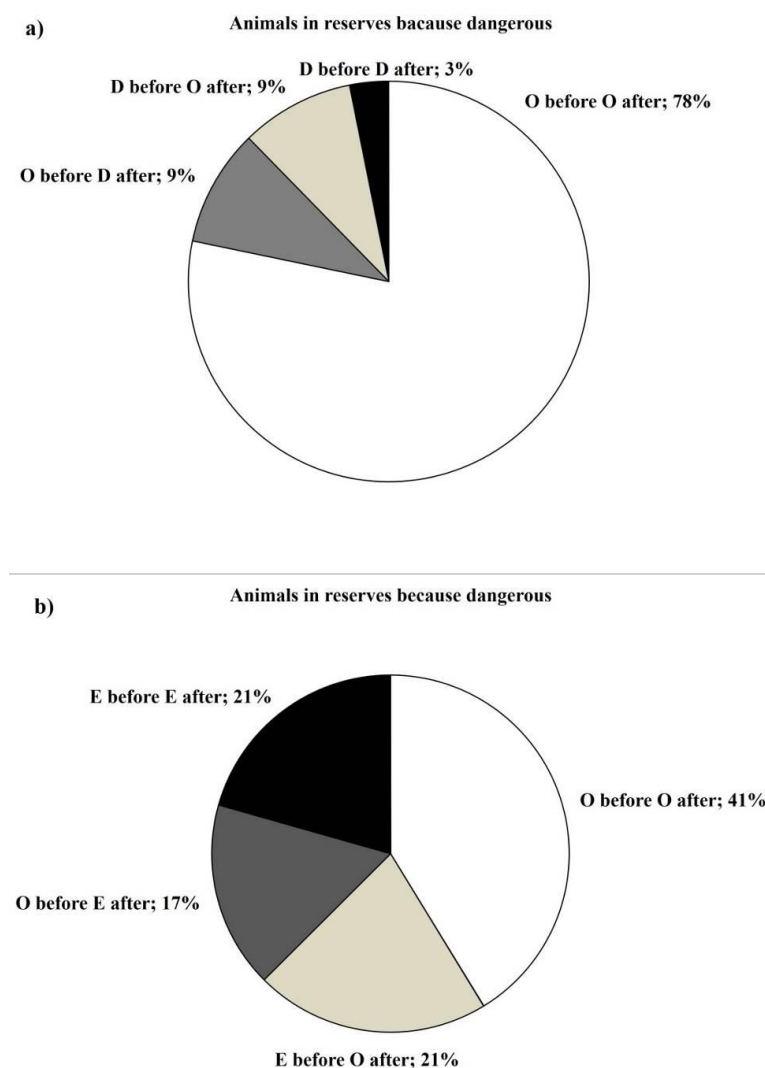


Figure 11. Percentage of respondents seeing animals in reserves as a) dangerous; b) reflecting their need to be protected. Abbreviations: D: dangerous, E: endangered, O: other reason.

### 5.1.3. Impact of the EE programme one year after participation

The knowledge of children measured in Q1 – Q3 increased immediately after the course. Although one year later a decrease in the number of points was recorded, it did not return to the original level (Figure 12). Males indicated before, immediately after and one year after the programme, on average, 3, 4.1 and 3.5 wild animals, whereas females stated 2.8, 3.7 and 3.3 wild animals in the consecutive questionnaires. In Q2 males indicated, on average, 0.8, 1.7 and 2.0 protected areas in Senegal compared to females naming 0.9, 2 and 1. Males named, on average, 0.7 protected animals before the education, 1.3 immediately after and 1 one year after in Fathala reserve. On the same question females named, on average, 1, 1.1 and 1.3 protected animals in Fathala reserve.

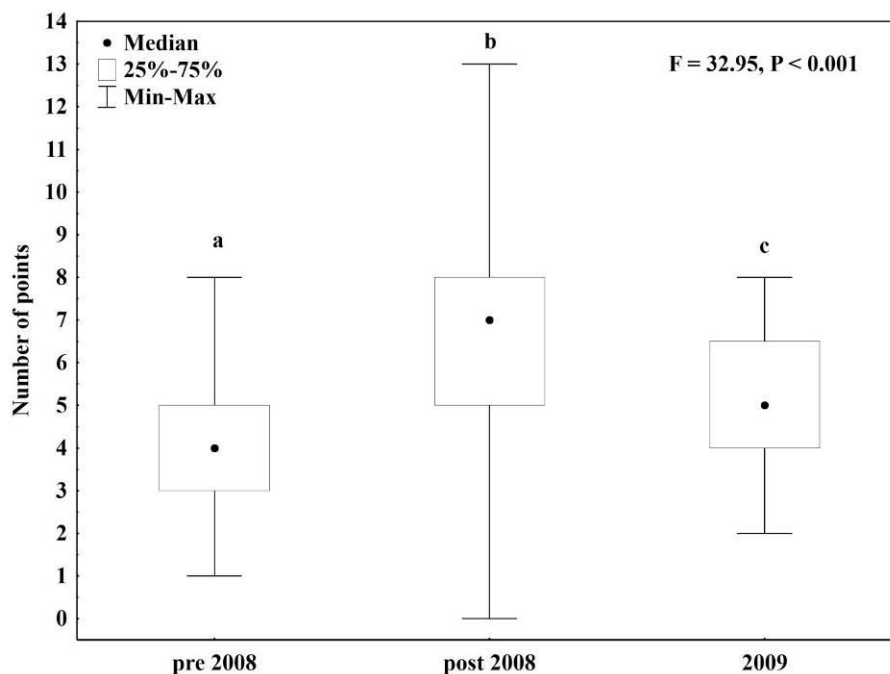


Figure 12. The number of points from questions 1, 2 and 3 answered by the same children before the education programme in 2008 (pre-2008), immediately after the programme (post-2008) and one year later in 2009 (2009). Different letters indicate a significant difference in the number of points tested by Tukey HSD test.

## 5.2. Reliability of the new environmental paradigm for analysing the environmental attitudes of Senegalese pupils in the context of conservation education projects

Citation: *Grúňová M, Sané M, Cincera J, Kroufek R, Hejcmanová P. 2018. Reliability of the new environmental paradigm for analysing the environmental attitudes of Senegalese pupils in the context of conservation education projects. Environmental Education Research 25: 1-11.*

Whole article in annexe 9.2.

Low correspondence with valid hypothetical NEP scale structure was detected by CFA. The factors were loaded significantly differently than in the original model (Table 2). Although all values (except of item 1 in the Urban group) are statistically significant, the loading itself often ranges below 0.35. In the context of the original, only the items 5, 9 and 10 are adequately loading the factors.

Table 2. Confirmatory factor analysis of the valid NEP model (original) with the obtained data (all) and the relevant groups (rural, urban). The values represent loading of the original factors by the individual items in the interval <-1;1>.

Factor	Item	Original (Manoli et al., 2007)	All	Rural	Urban
Human Exemptionalism	3	0.667	0.336	0.451	0.297
	6	0.614	0.242	0.371	0.214
	9	0.685	0.542	0.355	0.702
Rights of Nature	7	0.695	-0.298	-0.335	-0.405
	1	0.691	0.239	0.363	0.116
	4	0.640	0.363	0.283	0.613
	10	0.707	0.619	0.568	0.628
	2	0.663	0.253	0.309	0.187
Eco-Crisis	8	0.733	0.454	0.461	0.426
	5	0.459	0.728	0.843	0.655

The test of reliability revealed very weak reliability for the scale as a unidimensional measure (n=678; Cronbach's alpha=0.23) and for the subscales (Human Exceptionalism, Cronbach's alpha=0.28; Eco-Crisis, Cronbach's alpha=0.50; Rights of Nature, Cronbach's alpha=0.20, Table 2). The strongest consistency was found in items 2, 4, 5, 8, and 10;

Cronbach's alpha was 0.54, which did not reach the recommended level of internal consistency for the individual scale. Principal component analysis revealed three dimensions that explained 43% of the variance in the answers obtained. The first factor (item 4, 2, 5, and 10) explained 18.7% of the variance; the second factor (item 3, 6, and 9) explained 13.1% of the variance; and the third factor (items 8 and 9) explained 11.3% of the variance. The option with fourth-factor (item 1) adjustment explained a total of 53.5% of the variance. Because of the low internal reliability of the instrument, each of the items was analysed separately (for the results, see Table 4).

Table 3. Comparison of the subscales based on principal component analysis of the NEP scale for children. Rights of Nature, Human Exceptionalism, and Eco-Crisis are the subscales proposed by Manoli *et al.* (2007); Limits to Growth, Humans over Nature, and Balance of Nature are the subscales proposed by Van Petegem and Blicek (2006).

	<b>Region of study</b>	<b>Rights of Nature/ Limits to Growth</b>	<b>Human Exceptionalism/ Humans over Nature</b>	<b>Eco-Crisis/ Balance of Nature</b>
Manoli <i>et al.</i>	USA	1, 4, 7	3, 6, 9	2, 5, 8, 10
Van Petegem and Blicek *	Belgium, Zimbabwe	2, 4	3, 6, 7, 9	1, 5, 8, 10
Current investigation	Senegal	2, 4, 5, 10	3, 6, 9	8, 9

\*The items proposed by Van Petegem and Blicek (2006) were given appropriate item numbers in the current study. The four items that were employed by Van Petegem and Blicek (2006) that did not appear in Manoli *et al.*'s (2007) 10-item scale were not included in this table.

There was no significant difference between the male and female students' scores on all items ( $p > .05$  in all analyses). The children from urban schools scored higher on the item 2, 5, 8 and 9 (in all these analyses  $p.01$ ). Only the item 9 showed significant difference in the effect of interaction between gender and socio-economic background ( $F_{1,743} = 4.06, p=.04$ ), i.e. there was significant difference between high scores of urban male students and lower scores of rural male (the lowest) and female students. Female students were similar in urban and rural areas.

The interview revealed that the respondents associated the NEP/DSP items with interpretations that differed from those that were expected in the NEP's design. The main differences were the strong faith in an omnipotent God as the divine source of natural



harmony and stability. The other was a prevailing positive interpretation of the place of humankind in nature and our limited potential to damage nature. These aspects will be analysed separately.

Strong faith in God was expressed by most of the respondents and affected items 4, 7, 9, and 10. For example, on item 4, 'People must obey the laws of nature', a 12-year-old female respondent explained that '...they do it because nature is good and they want to... otherwise, they are stronger than nature, and if they are not, they can pray and make sacrifices, and a good God will do what they ask him to'.

The same arguments emerged in responses to other items. Commenting on item 7, the respondents stated that people are supposed to rule over nature by the will of god or that they are not supposed to rule over nature because there is a god who rules it. Similarly, for item 9, they argued that a god controls nature but can teach us to control it if he wants to, or, for item 10, that 'If there is a danger of disaster, we will pray and make sacrifices'.

In contrast, humans' potential to seriously damage the environment seemed to be underestimated, and the role of humankind in nature was perceived positively in item 1 and item 6. Item 1 was answered with 'animals and plants have as much right to live as humans because they are living things', and no discussion of the subject occurred in either of the two groups. The same was true for the responses to item 6, in which the children seemed not to be aware of problems connected with civilisation's progress.

The children's explicit understanding of certain items was evident on items 3, 8 and 5. Only two examples of mistreating nature, i.e., cutting trees and making charcoal, were provided by the respondents. Similar issues arose for item 3, for which all the interviewed children agreed that 'People are clever enough to avoid ruining the Earth' and for which a 12-year-old male respondent in one group replied that we just have to 'cease cutting trees and making bush fires'. For item 5, the interviewed children agreed that if people mess with nature, it has bad results. A 12-year-old male respondent gave the example that 'when people throw a mess into nature, an animal will eat it and die'. When asked why it is bad if an animal dies, he answered 'people will have nothing to eat, and it is the same with plants that die in forest fires'.

For respondents, item 2, 'There are too many people on the planet', appeared to have an opposite meaning in terms of environmental attitudes than what was anticipated in the scale. While the children tended to agree with the statement, they were unable to provide a plausible explanation of why the presence of too many people on the planet would have negative

consequences for the environment. Overpopulation is not regarded as having a negative association with disadvantages for nature and subsequent negative effects on humankind. Consequently, item 2 cannot be considered valid when the NEP subscale is applied for this population.

Table 4. Mean scores and frequency distribution of the responses to the 10-item NEP scale for children. The scores of the DSP items (Q 3, 6, 7, 9) are reversed so that all values below 3 indicate the respondent's support for the DSP worldview, while whole values above 3 support the NSP worldview; Manoli and current: the number of 10-scale items adopted from Manoli et al. (2007); PB: items corresponding to the 15-item scale for children proposed by Petegem and Blicek (2006); NEP and DSP indicate New Environmental Paradigm and Dominant Social Paradigm items. On the right side of the table, the frequencies of the responses are presented as percentages. SD=strongly disagree, D=disagree, I=indifferent, A=agree, SA=strongly agree

Manoli et al. and current	PB	Items	Score (mean±SE)	SD (%)	D (%)	I (%)	A (%)	SA (%)	Missing responses (%)
1	7	Plants and animals have as much right as people to live. NEP	3.7±.05	9	13	14	26	35	3
2	1	There are too many people on Earth. NEP	4.4±.03	2	2	7	31	57	1
3	4	People are clever enough to keep from ruining the Earth. DSP	2.3±.04	6	8	22	31	30	3
4	9	People must still obey the laws of nature. NEP	4.2±.04	2	6	10	28	52	2
5	3	When people mess with nature, it has bad results. NEP	3.7±.05	10	11	13	25	39	2
6	8	Nature is strong enough to handle the bad effects of our modern lifestyle. DSP	2.8±.05	15	12	27	24	18	4
7	12	People are supposed to rule over the rest of nature. DSP	2.5±.05	9	13	22	28	23	5
8	5	People are treating nature badly. NEP	3.6±.05	9	15	16	27	31	2
9	14	People will someday know enough about how nature works to be able to control it. DSP	2.2±.04	5	6	21	33	32	3
10	15	If things don't change, we will have a big disaster in the environment soon. NEP	4.2±.04	5	6	9	27	52	1

### 5.3. Do Short-duration Environmental Education Programmes and One-day Excursions Influence Senegalese Primary Schoolchildren's Environmental Attitudes? Save Your Money and Stay in the Classroom.

Mns: Grůňová M, Van Damme P, Hejčmanová P. Do Short-duration Environmental Education Programmes and One-day Excursions Influence Senegalese Primary Schoolchildren's Environmental Attitudes? Save Your Money and Stay in the Classroom. *Environmental Education Research*, under the review, submitted 05\_2019

Whole submitted Mns. in annexe 9.3.

Before start of intervention, average knowledge scores (points gathered in Q15-18) of respondents reached 6.3 points on a maximum of 19. Respondents' general environmental attitudes on eco-centric questions where answer 'I strongly agree' (value 1 on the Likert scale) meant an eco-centric positions (Q1, Q2, Q4, Q5, Q8) ranged 1.6- 2.5. On the other hand, respondents' attitudes on anthropocentric questions where the answer 'I strongly agree' meant an anthropocentric position (Q3, Q6, Q7, Q9) yielded Likert scale values between 2.2 and 2.8. Specific conservation attitudes ranged 2.1- 3.9 which indicated mostly positive conservation attitudes, with exception of question 11 (Table 5).

**Table 5.** Frequency distributions for the revised 10 question NEP for Children (Manoli et al., 2007) and specific nature conservation attitudes in pre, post and long term tests, frequency displayed as percentages

Question	Test	Score mean± SE	SA	A	I	D	SD	Missing responses	NEP *
1. Plants and animals have as much right as people to live. EC	pre	2.45±0.07	28.7	24.8	22.8	15.5	6.2	2.0	53.5
	post	2.46±0.07	31.0	21.5	21.1	17.8	6.3	2.3	52.5
	long	2.10±0.09	27.7	17.5	7.0	10.6	2.0	35.3	45.2
2. There are too many people on the planet. EC	pre	1.56±0.05	56.8	33.0	5.9	2.0	1.0	1.3	89.8
	post	1.58±0.05	54.8	35.3	5.9	1.7	1.3	1.0	90.1
	long	1.53±0.05	41.0	19.5	1.3	2.3	1.3	34.7	60.5
3. People are clever enough to keep from ruining the Earth. AC	pre	2.20±0.06	28.0	34.0	26.0	5.6	3.3	3.0	8.9
	post	2.34±0.06	26.4	30.0	25.4	11.6	3.6	3.0	15.2
	long	2.24±0.08	21.1	19.5	13.9	5.3	4.0	36.3	9.3
4. People must obey the laws of nature. EC	pre	1.77±0.05	46.2	33.3	10.9	4.3	1.7	3.6	79.5
	post	1.82±0.06	47.9	31.0	9.6	6.3	2.6	2.6	78.9

	long	1.51±0.06	42.2	15.6	5.0	1.7	0.7	35.0	57.8
5. If people pollute nature, there will be negative effects. EC	pre	2.02±0.07	43.2	25.7	13.6	9.6	4.2	3.6	68.9
	post	2.00±0.07	44.6	24.4	15.8	8.3	4.0	3.0	69.0
	long	1.83±0.08	33.7	18.2	5.9	4.0	3.0	35.3	51.9
6. Nature is strong enough to handle the bad effects of our modern lifestyle. AC	pre	2.79±0.07	14.5	24.8	34.7	12.5	10.6	3.0	23.1
	post	3.01±0.07	10.2	24.0	31.7	19.1	13.2	1.7	32.3
	long	3.25±0.09	5.6	10.9	21.1	14.2	11.9	36.3	26.1
7. People are supposed to rule over nature. AC	pre	2.74±0.07	15.2	25.1	33.0	12.5	9.0	5.3	21.5
	post	2.89±0.07	13.5	2.4	34.3	16.5	11.2	2.0	27.7
	long	2.85±0.07	11.5	12.9	21.5	10.9	7.6	35.6	18.5
8. People behave badly to nature. EC	pre	2.37±0.07	30.0	27.4	18.5	15.2	5.3	3.3	57.4
	post	2.31±0.07	30.4	32.0	14.9	15.2	5.3	2.3	62.4
	long	2.27±0.08	20.5	24.4	7.6	10.2	3.3	34.0	44.9
9. People will some day know enough about how nature works to be able to control its effects. AC	pre	2.17±0.06	29.0	37.3	23.8	3.0	5.3	1.7	8.3
	post	2.43±0.06	19.5	33.3	31.7	7.9	4.6	3.0	12.5
	long	2.30±0.08	17.5	20.1	20.8	2.6	3.6	35.3	6.2
10. If things don't change, we will have a big disaster in the environment soon. EC	pre	1.68±0.06	56.4	28.0	7.3	3.3	3.6	1.3	84.4
	post	1.80±0.06	52.5	28.7	6.6	5.9	4.6	1.7	81.2
	long	1.65±0.07	38.0	19.5	4.3	1.3	2.6	34.3	57.5
11. I would prefer to have an amusement centre constructed over a nature reserve with wild animals in the proximity of my city/village SA	pre	2.98±0.09	21.5	26.7	7.6	15.8	26.1	2.3	41.9.
	post	3.15±0.09	18.5	24.8	8.9	17.5	29.4	1.0	46.9.
	long	3.22±0.12	15.2	11.9	5.9	8.6	24.1	34.3	32.7.
12. I think that people from my city/village should be authorised to hunt in the natural reserves. SA	pre	3.9±0.07	5.9	9.6	13.2	29.4	40.6	1.3	70.0.
	post	3.85±0.07	8.3	8.6	12.2	30.7	39.3	1.0	70.0.
	long	3.88±0.09	5.3	6.9	7.3	16.5	29.0	35.0	45.5.
13. I consider protection of the Derby eland in my country very important. SA	pre	2.1±0.06	31.7	34.7	24.4	3.6	3.3	2.3	66.4.
	post	1.62±0.05	53.5	35.0	7.3	1.3	2.0	1.0	88.5.
	long	1.6±0.06	37.3	19.8	3.6	2.6	1.0	35.6	57.1.
14. Only rich countries should protect the environment. SA	pre	3.86±0.07	9.6	6.0	11.6	33.3	38.6	1.0	71.9.
	post	4.07±0.06	4.3	6.6	8.3	38.6	40.9	1.3	79.5.
	long	4.35±0.07	2.6	2.3	3.6	17.8	38.0	35.3	55.8.

Notes: EC indicates eco-centric questions (New Environmental Paradigm), AC indicates anthropocentric questions), SA indicates specific conservation attitudes SD = strongly disagree, D = disagree, I = indifferent, A = agree, SA = strongly agree.\* The NEP was calculated as the sum of the positive response frequencies for each item: SA plus A for the ecological questions and (1, 2, 4, 5, 8, 10, 13), D plus SD for the anthropocentric questions and (3, 6, 7, 9). The sum of positive responses was calculated for positively formulated specific conservation questions (13) and negative responses for negatively formulated conservation questions were adjusted to the column NEP (11, 12, 14)

**5.3.1. Does socio-economic background of schoolchildren influence their environmental knowledge and attitudes?**

The pre-test knowledge scores of children whose father works in agriculture (mean score  $5.5 \pm 0.3SE$ ) or as waged labourer (mean score  $5.9 \pm 0.3SE$ ) was at the similar level, while children with a father with a higher education degree (mostly worked as state employees) achieved significantly higher knowledge scores than the other groups (mean score  $7.6 \pm 0.3SE$ ) ( $F=17, p<0.01$ ). Children with a father with higher education scored more eco-centrally and less anthropocentrically, and were more supportive of conservation than children with fathers working in agriculture (Q4, Q7, Q8, Q12), as a labourer (Q13) or than both, i.e. children with fathers working in agriculture and waged labourers (Q2, Q5, Q6, Q9, Q10, Q11 and Q14). In Q1, children with higher-education fathers scored significantly more anthropocentrically than children with a father working in agriculture (all  $p<0.01$ ).

There was no difference in knowledge or attitude scores of children grouped per ethnic group except of Q3, Q7 and Q9. In Q3, Mandingue children were shown to take an eco-centric position, whereas Wolof, Serer and Toucouleur appeared to be anthropocentric; in Q7, Toucouleur were more eco-centric than Mandingue and Fulani, respectively; in Q9, Mandingue were more eco-centric than Wolof and Serer, respectively (all  $p<0.01$ ).

Table 6. Mean and median number of wild, domesticated and alien animals named on request ‘Write names of 10 wild animals living in Senegal’ in pre-test. Urban= children from urban schools, rural= children from rural schools.

	URBAN (N=152)		RURAL (N=143)	
	mean	median	mean	median
WILD	4.7	5	3.3	3
DOMESTICATED	1.0	0	1.6	1
ALIEN	0.8	1	0.4	0

Children from urban areas initially achieved higher knowledge scores (mean score  $6.9 \pm 0.3SE$ ) than children from rural areas (mean score  $6 \pm 0.2SE$ ) ( $F=7.5, p<0.01$ ). The difference in pre-test attitudes between children from urban and rural schools appeared highly significant in all questions except for Q3, Q4 and Q7. Urban children scored higher on eco-centric attitudes (Q2, Q4, Q5, Q8, Q10, all  $p<0.01$ ) and anti-anthropocentric attitudes (Q6,

Q9,  $p < 0.01$ ) and were more in favour of conservation (Q11,  $p < 0.01$ ) than rural children. Only in Q1, did urban children scored lower on eco-centric questions than rural children.

Numbers of correctly named wild animals living in Senegal together with numbers of domesticated and alien species perceived as wild Senegalese animals are given in Table 6. Children from urban areas significantly listed more wild animals present in Senegal ( $F=20$ ,  $p < 0.001$ ). Moreover, while children from urban areas tended to incorrectly list non-indigenous (tiger, bear) species, children from rural areas listed less non-indigenous species and included incorrectly more domesticated (horse, goat) ones than children from urban areas.

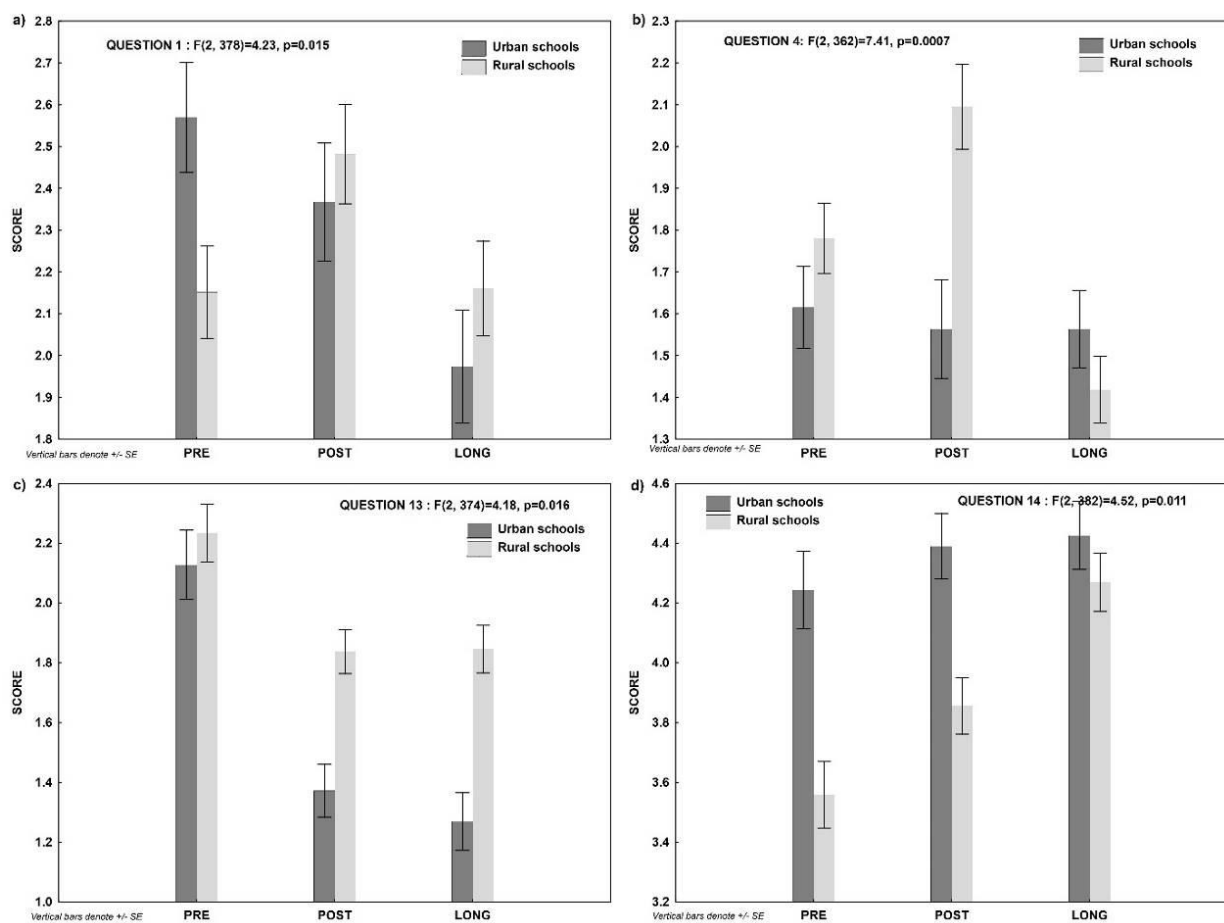
### ***5.3.2. Environmental education programme effect on environmental knowledge and attitudes of children***

Specific environmental knowledge points reached an average value of 6.4 in pre-test ( $\pm 0.2$  SE), an average of 9.6 points ( $\pm 0.3$  SE) one month after the programme, and an average of 10.4 points one year after the programme ( $\pm 0.3$  SE).

Mean scores and frequency distribution of pre-, post- and long-term attitude scores (Q1-Q10 for NEP scale for children; and Q11-Q14 on specific conservation attitudes) are given in Table 5. The NEP values on questions 1, 2, 4 and 5 remained almost unchanged in the post-test and the values ranged within eco-centric positions. With Q8, 5% more children answered yes on '*People behave badly to the environment*' in the post-test, evidencing that the latter had brought about a shift towards eco-centrism, whereas with Q10 3% less children answered yes evidencing a negative shift but still in eco-centric range. In all anthropocentric questions 3, 6, 7, 9 respondents were shown to hold utilitarian positions in pre-test, weakening in post-test.

Respondents held pro-conservation attitudes during the pre-test, except for Q11. Whereas in Q11 respondents were not in favour of conservation before the programme, they have shifted to pro-conservation positions after the programme. Responses on Q12 remained almost unchanged between pre- and post-test whereas pro-conservation attitudes of respondents further deepened in Q13 and Q14 as evidenced in lower NEP score of Q13 and higher score in Q14.

Long-term results in all eco-centric, anthropocentric and specific conservation attitudes were influenced by the high number of missing responses (34 - 36%). In all questions (except for Q2 and Q7), the percentage of low post-test values were proportionate to the percentage of low long-term values and the percentage of high values in the pre-test corresponded to the percentage of high values in the long-term test. In Q2 ‘*There are too many people on the planet*’, less respondents agreed in the long term test while percentage of disagreeing respondents remained similar as in the post- test. In Q7 ‘*People are supposed to rule over the nature*’ more respondents agreed in the long term test and less disagreed than in the post-test (Table 5.).



**Figure 12.** Difference in effect of the programme on urban and rural children in Q1, Q4, Q13 and Q14 ( $p < 0.05$ ). Scores are compared in pre-, post- and long-term test.

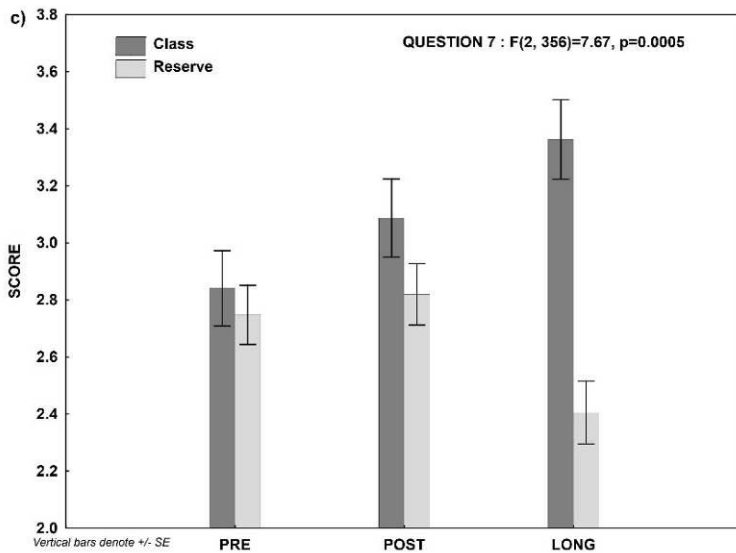
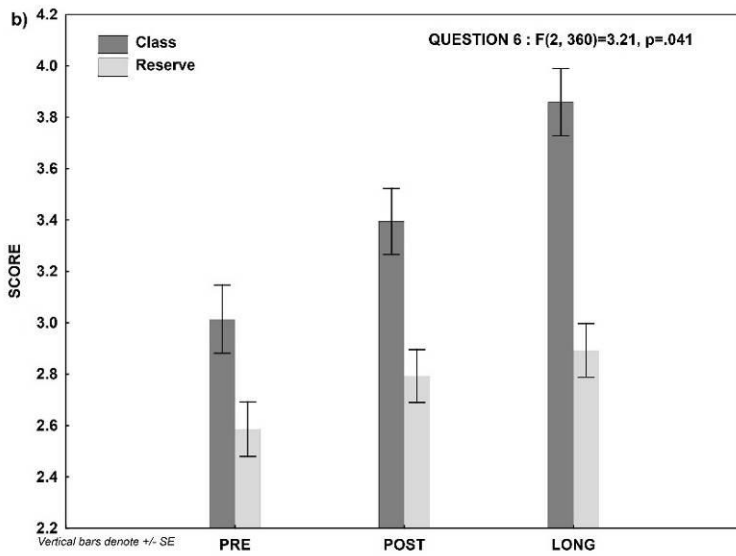
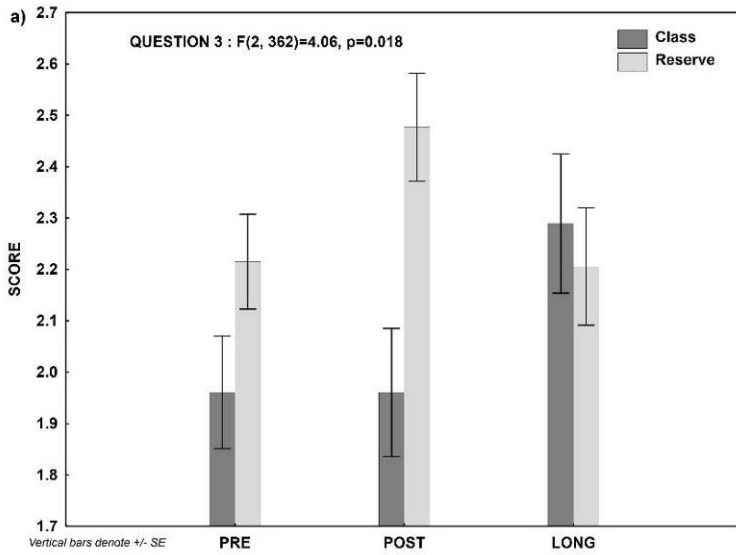


The programme had different effects on the attitudes of children from rural and urban areas for Q1, Q4, Q13 and Q14 (all  $p < 0.01$ , Figure 12). In Q1, anthropocentric values of children from urban areas weakened in post-test whereas children from rural areas moved towards anthropocentric positions. In Q4, the attitudes of children from urban areas remained the same, whilst eco-centric positions of rural children weakened in post-test and increased again with the long-term test. Q13 post-scores of urban children moved more distinctly towards conservation than those of children from rural schools. The very high initial scores in favour of conservation for Q14 of urban children remained almost unchanged, whilst rural children's scores further increased towards conservationism to reach a similar level with those of urban children.

### ***5.3.3. Does participation in an outdoor excursion affect the knowledge and attitudes of children?***

The initial knowledge of respondents in the so-called 'Reserve' and 'Class' groups differed significantly before the exposure ( $\text{mean}_R = 5.8$ ,  $\text{mean}_C = 7.3$ ). The knowledge of both groups increased to a similar level after exposure to the programme ( $\text{mean}_R = 9.7$ ,  $\text{mean}_C = 9.5$ ) and to  $\text{mean}_R = 10.4$ ,  $\text{mean}_C = 10.5$  one year after exposure.

The attitudes of respondents in so called 'Class' and 'Reserve' groups differed significantly before exposure to the programme for half of the questions (Q3, Q6, Q7, Q10, Q11, Q12 and Q14, all  $p < 0.01$ ). The short- and long- term effect of programme location (in class or in reserve) on respondents' attitudes was significant in Q3 ( $F = 3.8$ ,  $p < 0.01$ ), Q6 ( $F = 3.7$ ,  $p < 0.01$ ) and Q7 ( $F = 5.4$ ,  $p < 0.01$ ). In questions 6 and 7 the Class group weakened its anthropocentric position in both post- and long term tests. In question 3 the Class group weakened its anthropocentric position in the post-test and scored higher again during the long-term evaluation. The Reserve group had similar scores or slightly lowered their anthropocentric positions in post- and long term tests (Figure 13).



**Figure 13.** Effect of the two types of programme on participating children in Q3, Q6, Q7 ( $p < 0.05$ ). Class group participated the programme in school classroom the second day of exposure. Reserve group was exposed to the same programme, but in the natural reserve. Scores are compared from pre-, post- and long-term test.

#### ***5.3.4. Do environmental attitudes correlate with specific knowledge related to nature conservation in Senegal?***

Higher pre-test knowledge scores were found to correlate with eco-centric, anti-anthropocentric or positive specific conservation pre-test attitudes among respondents in questions 2, 4, 5, 6, 9, 10, 11, 12 and 14 (Table 7).

Most of the correlations of attitudes with knowledge that appeared in pre-test did not appear again in post-test. Exceptions were Q5 (Spearman  $R = -0.1$ ;  $p < 0.05$ ); Q11 (Spearman  $R = 0.12$ ;  $p < 0.05$ ); Q12 (Spearman  $R = 0.2$ ;  $p < 0.05$ ). In Q13 ('I consider protection of Derby eland in my country very important'), correlation between attitudes and knowledge scores did not appear in pre-test and appeared in post-test (Spearman  $R = -0.15$ ;  $p < 0.05$ ). Correlation between knowledge and attitude scores in the long-term test remained in three questions: in Q10 (Spearman  $R = -0.2$ ;  $p < 0.05$ ); Q11 (Spearman  $R = 0.1$ ;  $p < 0.05$ ); and Q12 (Spearman  $R = 0.2$ ;  $p < 0.05$ ).

**Table 7.** Spearman rank correlation between pre-test knowledge and attitude questions. Lower scores in eco-centrally and positively oriented conservation attitude questions indicated eco-centrism, therefore the negative Spearman R indicates positive correlation of eco-centrism and positive conservation attitudes with higher knowledge scores.

<b>Question</b>	<b>Spearman R</b>	<b>p-value</b>
1. Plants and animals have as much right as people to live	0.047	0.45
2. There are too many people on the planet	-0.12	0.05
3. People are clever enough to keep from ruining the Earth	0.8	0.19
4. People must obey the laws of nature	-0.11	0.65
5. If people pollute nature, there will be negative effects	-0.29	<0.05
6. Nature is strong enough to handle the bad effects of our modern lifestyle.	0.31	<0.05
7. People are supposed to rule over nature	0.11	0.090
8. People behave badly to nature	-0.85	0.17
9. People will someday know enough about how nature works to be able to control its effects	0.16	<0.05
10. If things don't change, we will have a big disaster in the environment soon	-0.2	<0.05
11. I would prefer to have an amusement centre constructed over a nature reserve with wild animals in the proximity of my city/village	0.3	<0.05
12. I think that people from my city/village should be authorised to hunt in the natural reserves	0.17	<0.05
13. I think protection of the Derby eland in my country to be very important	-0.2;	0.7
14. Only rich countries should protect the environment	0.31	<0.05

Children achieving higher knowledge scores in the post-test were more likely (77% probability) to name Western Derby eland within Senegalese wild animals, (odds ratio = 11,  $\chi^2_{(1)} = 138, p < 0.001$ ).

## 6. DISCUSSION

While the Western Derby eland conservation strategy assumes that its success depends largely on the environmental behaviour of the local community, the practical impact of environmental education on attitudes, behaviour, and consequently on conservation activities, is not without doubts. Many talks have been led amongst psychologists, sociologists, and conservationists (Bamberg & Möser 2007; Baruch-Mordo et al. 2011; Pedro & Pedro 2010; Zsóka et al. 2013) over the role of education in conservation attempts, and this dissertation thesis intends to contribute to this discussion with our field experience and data based research.

### 6.1. Pilot study and evaluation gaps

In 2008 and 2009, a pilot study which later provided further insight in conservation based environmental education evaluation techniques was conducted in the surroundings of the Fathala reserve, Senegal- one of the two places possessing semi-captive population of Western Derby Eland. An increase in conservation related knowledge after the programme was recorded, which confirmed basic presumption of many conservation related environmental education programmes (Chipembele 2014; Save the Rhino 2014; Fernan-Vaz Gorilla Project 2014). On the other hand no desired effect on conservation related attitudes was recorded, which could mean either unsuitable design of environmental education programme (Kuhar et al. 2007) or its evaluation instruments (Carleton-Hug & Hug 2010). Although most of published evaluations of impact of environmental education programmes on respondents attitudes confirmed desired effect (Boerchers et al. 2014; Dieser & Bogner 2017; Liefländer, et al. 2013), our findings are not unprecedented as Espinosa and Jacobson (2012) recorded no attitudinal change after environmental education activities focused on Andean bear protection. Consequently, it was recognised that the evaluation scheme should be re-designed in order to make results available for comparison with studies in different socio-geographical settings (Carleton-Hug & Hug 2010; Koprina 2011). The fact that positive shift in attitudes was not achieved also opened a subsequent challenge for educational team; to work out the ways in which an environmental programme will successfully influence environmental attitudes.

## **6.2 New Environmental Paradigm scale in Senegalese socio-cultural settings**

Confirmatory factor analysis revealed that the NEP scale (Dunlap et al. 2000) behaves in non-standard way in Senegalese settings. Two possible explanations are available: language and/or culture explanation. Despite the piloting of the translated instrument, wording may have been an issue. For instance the difference in understanding of the word ‘salir’ (‘mess up’ in French) found between children in the preliminary study and the ex-post interviews suggests possible difference in understanding of children among Senegal’s schools of the same types and level. In comparative study of Schultz et al. (2005), low internal consistency of translated versions of the NEP Scale was found in Brazil and India, while in the Czech Republic, Germany, Russia or New Zealand the consistency revealed acceptable. In this light the culture rather than language would be the source of the instruments’ reliability. Interestingly, at least one dimension of the NEP Scale (Human Exceptionalism/Humans over Nature) seems to be consistent across cultures (Dunlap et al. 2000) and was found coherent also in our study. However, it should be mentioned that all the subscale items are worded in an anti-NEP direction and might represent a ‘methodological artefact’ (Dunlap et al. 2000).

While the quantitative findings might seem to suggest that most of the Senegalese children hold eco-centric attitudes, the qualitative analysis suggests that answers might be undermined by different mental constructs of environmental values in different cultures (Bechtel et al. 2006; Bechtel et al. 1999; Corral-Verdugo & Armendariz 2000; Ogunbode 2013; Van Petegem & Blicek 2006). For instance quantitative data on Q2 suggested eco-centric position of most of the respondents on threats of overpopulation. However interviews revealed that overpopulation was considered neither an environmental threat nor a potential threat for humankind. At the same time, Senegalese children believe that nature (Q6) or people (Q3) can handle the bad effects of modern life. The anthropocentric position in those items was also identified in Belgian and Zimbabwean children (Van Petegem & Blicek 2006) and Nigerian students (Ogunbode 2013). While Van Petegem and Blicek (2006) stated that children displayed faith in the problem-solving abilities of science and technology, we suggest that this might also result from underestimating humans’ negative effects on the environment, and from believe in supernatural forces. The latter is supported in Ogunbode (2013) who found Nigerian students to agree with item 9, ‘Humans will eventually learn enough about

how nature works to be able to control it'. He argues that Nigerians may conceive the gain of control over nature through spiritual empowerment, independent of modern techniques.

The high level of agreement with contrary sentences such as Q1, 'Plants and animals have as much right to live as people', and Q7, 'People are supposed to rule over the rest of nature', may be explained by combination of perception through monotheistic religions and persisting animism within the population. While the religions of the Book (Judaism, Christianity and Muslimism) see nature as something given to man for his use, widespread belief in supernatural forces and the role of ancestors enables members of the population to view themselves as an equal part of the nature (Dieye & Roy 2012). Further research on structure of environmental attitudes should be performed to confirm this primary assumption.

However Senegalese children scored high on eco-centrally oriented questions both in pre- and post-test, they also scored high on anthropocentric questions, which was not usual in previous studies in western nations (Dunlap et al. 2000; Manoli et al. 2007). In western nations, people hold either eco-centric or anthropocentric/utilitarian positions. The so called dualism was challenged in developing nations (Corral-Verdugo & Armendariz 2000; Ogunbode 2013; Van Petegem & Blicck 2006). This is believed to be due to much more holistic approach to the human-environment relationship of people in developing countries than those in the western world. Consequently, the author suggests that adapted 2-MEV should be examined in Senegalese settings. This is supported in Manoli et al. (2019), who found that the NEP fails to differentiate between individuals scoring high on eco-centrism and anthropocentrism versus respondents scoring low on eco-centrism and anthropocentrism, while 2-MEV allows distinguishing between them.

### **6.3. Demographic variables of environmental knowledge and attitudes**

Age and gender were evaluated as basic demographic variables playing role in environmental education process both in 2008-2009 and 2015-2016. We did not confirm hypotheses of younger children being more receptive towards environmental message (Berk 2004; Liefländer & Bogner 2014). On the contrary it was found that environmental knowledge correlates positively with age. The same was found in Boerchers et al. (2014) who argue that older children might have higher potential to integrate new knowledge due to their already existing broader cognitive map compared to their younger peers. However some of the available studies found that the NEP score negatively correlates with age (Gangaas et al.

2015; Parizanganeh et al. 2011), findings of this study support Hawcroft and Milfont (2010) who found no such correlation.

There was no significant difference between the male and female respondents' knowledge scores and most of environmental attitude items. This result is in line with Hawcroft and Milfont (2010), who did not find a relationship between gender and NEP scores. However, other studies (Bogner & Wiseman 2004; De Lavega 2004; Milfont & Duckitt 2004) did find such a relationship. These findings may be considered very encouraging, especially in Sub-Saharan Africa, where women's empowerment has not yet been fully realized (WB 2016) and are supported by relatively high gender equality recorded within Senegalese primary education (World Bank 2017). This further corresponds with the findings of Ogunbode et al. (Ogunbode 2013; Ogunbode & Arnold 2012), who found no gender differences in the environmental attitudes of Nigerian respondents.

We found that children from different socio-economic backgrounds differ in knowledge and attitudes in the pre-test. Children from rural schools and with father with jobs requiring higher education (mostly assigned as working for the state) scored higher on knowledge questions, were inclined to eco-centrism and less anthropocentric, and felt more in favour of nature conservation. Only on Q1 'Plants and animals have as much right as people to live', did this group score lower on eco-centrism than rural children and children with a father working in agriculture. Answers to Q1 would seem to be influenced by closer physical contact with nature of rural children and children with farming background, and at the other hand detachment from natural world of urban children. In overall, we conclude that positive attitudes towards environment and its conservation possibly result from level of children's education (higher in urban schools in Senegal) which goes in line with many studies confirming positive environmental attitudes to be positively correlated with level of education (Dunlap et al. 2000; Howell & Laska 1992; Van Liere & Dunlap 1980; Powers 2004; Kopnina 2011; Tessema et al. 2010, Tranter 2011, Shen & Saijo 2007) and/or sociological backgrounds given by their family intellectual environment (Casey & Scott 2000; Dunlap 2000; Jones & Dunlap 1992).

The children who attended urban schools scored higher than the rural schoolchildren on almost all the items. This finding is in accordance with Tremblay and Dunlap (1978) and Ogunbode and Arnold (2012), who suggest that individuals tend to be more concerned about environmental issues that may immediately and directly affect their daily life, such as air pollution or waste management issues, which Senegalese children living in polluted cities are



familiar with. Urban residence was accordingly a predictor for pro-environmental attitudes of most studies reviewed in Van Liere and Dunlap (1980) or in Howell and Laska (1992). Given that urban children receive a better education or/and have better access to the media, Mayer and Frantz's (2004) argument that the NEP scale measures cognitive beliefs rather than affective experience should be taken into an account.

The structure of responses on animals considered as wild and present in Senegal differed between urban and rural children. While children from urban areas tended to incorrectly list non-indigenous species (tiger, wolf), children from rural areas avoided non-indigenous species and included incorrectly domesticated ones such as cow, goat or horse. This difference can be assigned to different exposure to media, such as TV, to which the urban children have better access, whereas rural children spend more time outdoors surrounded by domesticated animals.

No difference was found in the attitudes of different ethnic groups (except for Q3, Q7 and Q9 and without any clear recognisable pattern) which could be influenced by multi ethnic settings of the study area. The study was carried out in the wealthier regions in Senegal (Dakar and Thiès), with high internal immigrant numbers, where all ethnic groups appear together and thus live under comparable conditions. We therefore suggest that ethnic origin is not an influential variable for shaping the knowledge and environmental attitudes of children living in this multi-ethnic environment. We have to highlight that the numbers of children from different ethnic groups in this study were imbalanced (Serers and Wolof being represented by over 85% of respondents), which could have influenced the results. As in author knowledge, no study has been published on role of ethnicity in environmental attitudes so far. This is probably to the fact that most studies on environmental attitudes have been realised in nations where ethnics play minority role in society or are neglected.

#### **6.4. Influence of environmental education programme on children's knowledge and attitudes**

The specific environmental knowledge of participating children increased after exposure to the programme from 6.4 points to 9.6 points in post-test and to 10.4 points in the long-term test. The increase in specific environmental knowledge in the long-term test in comparison to those of post-test can be assigned to respondents' higher ages and levels of

education as well as to their increased interest in wildlife and more proactive search for information.

The most affected eco-centric question by exposure was Q8 'People behave badly to the environment' where 5% more children answered positively after the programme. The programme was although found to have a negative effect on children's beliefs in nature having limits, where on Q10 'If things don't change we will have a big disaster in the environment soon' 3% less children answered yes during post-test phase than in pre-test. Utilitarian positions that children held in all anthropocentric questions Q3, Q6, Q7 and Q9 in pre-test, weakened after exposure to the programme, and spanned slightly to eco-centric positions in Q6 'Nature is strong enough to handle the bad effects of our modern lifestyle'. This suggests the 2-day environmental education programmes have a limited potential to further increase already existing eco-centric attitudes, and/but can weaken the anthropocentric/utilitarian positions of the exposed children. The higher effect of environmental education interventions on utilitarian factors rather than on preservation was described by Bogner (2002), and Sellman and Bogner (2013) who argued that this was probably due to the fact that the education programme was focused on utilitarian topics, rather than on preservation. As in the present programme both eco-centric and anthropocentric issues were addressed, we assume that anthropocentrically oriented questions were affected because there was simply more room for change (respondents scoring already high in eco-centrism before the intervention). In addition to which, it is possible that some answers that we interpreted as eco-centric rather suggest anthropocentric positions in the minds the respondents (Ogunbode 2013).

Specific attitudes to conservation of the respondents in the pre-, post and long term tests ranged within pro-conservation positions except for Q11 'I would prefer an amusement centre to be constructed near my village/city over a nature reserve'. The impact of the two-day education programme on respondents' conservation attitudes was positive except for Q12 where 16% of children before the programme and 17 % after the programme thought that 'People from their village should be authorized to hunt in the nature reserve'. This may result from a misunderstanding coming from the difference in cognitive map of Senegalese children compared to that of the westerners who designed the programme (Chatterjee 2008), and is yet to be explored. It is also possible that children who agreed on hunting in the reserve against children, who did not agree, had already such strongly fixed beliefs that a two-day programme could not change. The number of children who considered protection of the Derby eland

important in their country increased from 66% before to 89% after the programme. Considering that almost no respondents were familiar with the Derby eland before the programme, we assign the high rate of positive responses in pre-test to demand bias. Even though we limited the information given to the children prior to pre-test, we could not assure that their teachers did not communicate the purpose of the programme. It is also possible the children simply assumed that the Derby eland, regardless of what it is, is something of particular interest to us once we are asking it in the questionnaire.

It was shown that although the outdoor excursion had slightly higher effect on knowledge of participating children, than corresponding indoor programme, there was no effect on their environmental or conservation attitudes. This was previously find in Bogner (2002), Frantz and Mayer (2014) or Sellmann and Bogner (2013) who questioned efficiency of short- term outdoor excursion in influencing environmental attitudes of participants and argued children are more focused in class and education tends to be better structured there. Given that the two groups ended at the similar knowledge scores level, it is also possible that potential of the programme to increase environmental knowledge of the participants was simply reached. As of authors' knowledge, no systematic study had been published on effect of one- day outdoor excursion as a tool to foster wildlife conservation, even though the excursion has been widely used for this purpose (e.g. Chipembele 2013; Rakotomamonjy et al. 2014; Bobek 2013) so far and this thesis therefore brings new insight into the field.

We found that the level of specific knowledge about nature and its protection in Senegal correlates positively with eco-centric environmental attitudes as suggested e.g. in Kaiser et al. (2008) in pre-test questions Q2, Q4, Q5, Q6, Q9, Q10, Q11, Q12, Q13 and Q14. Such a correlation did not appear in most of the questions except of Q5, Q11 and Q12 in post-test and Q10, Q11 and Q12 in long-term test.

Having recognised the lower response rate in open-ended questions in 2008-2009 study, we deliberately aimed multiple-choice questions, ordering items, binary items and supply items (Slavík 2012) which was one of the decision points that resulted in Likert scale based scale in 20015-2016 evaluation. Nevertheless we recorded similar issue in the 2016 long-term test (response rate 34 - 36%) which suggests that three tests with the same questionnaire might not be the best practice and should be faced in future studies.

## 7. CONCLUSION

The research on Senegalese children's attitudes and the potential of educational intervention to affect them shows that a two-day environmental education programme positively increases knowledge, weakens respondent's anthropocentric attitudes and positively moderates already existing pro-conservation attitudes. The one-day excursion was not proven to be more efficient in increasing knowledge scores, enhancing eco-centric and pro-conservation attitudes or weakening anthropocentric attitudes, than a corresponding indoor programme. Therefore, it seems reasonable in the case of limited financial resources to suggest educating more children in class than to invest in a one-day excursion.

The results of this thesis have been used for the improvement of Western Derby eland conservation's environmental education programmes which have been continuing to accommodate over 700 children per year since 2015. Although the programmes continue with outdoor excursions, more importance has been assigned to the in class part. Recommendations were made towards use of alternative measures of children's environmental attitudes in Senegalese settings.

Furthermore, it was shown that certain socio-economic factors significantly influence children's attitudes towards environment and its conservation. Those findings support suggestion that higher education plays in favour of any conservation programme and in the case of abundant financial resources, it might be a good idea to foster general education in areas of the conservation programme.

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## 9. ANNEXES

### 9.1. Environmental education supports conservation action by increasing the immediate and long-term environmental knowledge of children in West Africa.



Figure I. Children during education programme in Fathala reserve, photo credits Derbianus Conservation

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**9.2. Reliability of the new environmental paradigm for analysing the environmental attitudes of Senegalese pupils in the context of conservation education projects.**



Figure II. Data collection in CEM Sessen

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### 9.3. Do Short-duration Environmental Education Programmes and One-day Excursions Influence Senegalese Primary Schoolchildren's Environmental Attitudes? Save Your Money and Stay in the Classroom.



Figure III: Children during outdoor excursion in Bandia reserve, photo credit: Jana Ptačinská Jirátová

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### **Peer Reviewed Articles:**

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**Grůňová M**, Sané M, Cincera J, Kroufek R, Hejčmanová P. (2018). Reliability of the new environmental paradigm for analysing the environmental attitudes of Senegalese pupils in the context of conservation education projects. *Environmental Education Research* **25**: 1-11.

### **Mns under review:**

**Grůňová M**, Van Damme P, Hejčmanová P., Do Short-duration Environmental Education Programmes and One-day Excursions Influence Senegalese Primary Schoolchildren's Environmental Attitudes? Save Your Money and Stay in the Classroom. *Environmental Education Research*, under the review, submitted 05\_2019

### **Other publications:**

Brandlová K, Jůnková Vymyslická P, Kubátová A, Žáčková M, **Grůňová M**, Fedorova T, 2016. African Studbook. Western Derby Eland, *Taurotragus derbianus derbianus* (Gray, 1847), volume 9, Praha: Czech University of Life Sciences Prague, 86 p. ISBN 978-80-213-2739-9.

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### **Chosen conference proceedings and posters:**

Brandlová K, Štochlová K, Kubátová A, Fedorova T, **Grůňová M**, Gloneková M, Miřejovská M, Hejčmanová P. 10 years of the Western Derby eland studbook - where we are now? EAZA Annual Conference 2018. Athens, Greece. 18 – 22nd September. Poster presentation.

Brandlová K, Hejčmanová P, Kubátová A, Štochlová K, Gloneková M, **Grůňová M**, Miřejovská M, Fedorova T. Research for Conservation Management Planning: The case of Western Derby eland in Senegal. Global Biodiversity Conservation Conference 2018. Prague, Czech Republic. 25 – 26th September.

- Brandlová K, Hejčmanová P, **Grůňová M**, Fedorova T, Kubátová A, Gloneková M, Mířejovská M, Štochlová K. 2018. Derby eland conservation update. Mid-year. AG TAG EAZA Chester, United Kingdom. 8. – 12. April.
- Brandlová K, Hejčmanová P, **Grůňová M**, Fedorova T, Kubátová A, Gloneková M, Mířejovská M, Štochlová K. 2018. The Western Derby Eland Conservation Programme. 18th Annual Sahelo-Saharan Interest Group Meeting, Paris, France. 2 – 5 May 2018.
- Brandlová K, Hejčmanová P, **Grůňová M**, Gloneková M, Žáčková M, Kubátová A, Jůnková Vymyslická P, Fedorova T, 2017. Conservation breeding of Western Derby eland – history and challenges. Antelope, Giraffe, Hippo in the 21st Century: Conservation Action in Africa, CULS Prague, Czech Republic February 19 - 25, 2017, p. 33.
- Brandlová K, Jůnková Vymyslická P, Fedorova T, Kubátová A, Žáčková M, Gloneková M, **Grůňová M**, Hejčmanová P. 2016: Last living Western Derby elands need our attention. EAZA Annual Conference 2016, Belfast, Northern Ireland. Poster presentation.
- Grůňová M**, Hejčmanová P. 2017. Positive effects of direct experience with critically endangered Western Derby elands within environmental education programmes: new concept of evaluation of education programs in Senegal. 17th Annual Sahelo-Saharan Interest Group Meeting. Saint Louis, Sénégal.
- Grůňová M**, Sané M, Brandlová K, Svitálek J, Hejčmanová P. 2017. Conservation by Awareness to Species Survival. As Easy as That? Evaluation of environmental education programme within Western Derby eland (*Taurotragus derbianus derbianus*) conservation in Senegal breeding of Western Derby eland – history and challenges. Antelope, Giraffe, Hippo in the 21st Century: Conservation Action in Africa, Prague, Czech Republic. Book of Abstracts, p. 41. 19 – 25 February 2017.
- Grůňová M**, Hejčmanová P, Brandlová K, Gloneková M, Fedorova T, Žáčková M, Kubátová A, Štochlová K. 2017. Senegalese children are getting to know Western Derby eland... And to value it? New concept of evaluation of education programs within Derby eland conservation programme in Senegal. EAZA Annual Conference, Emmen, Netherlands. Poster presentation.
- Grůňová M**, Sané M, Svitálek J, Brandlová K, Hejčmanová P. 2017. By awareness to successful conservation? International Wildlife Symposium 2017, Sri Lanka.
- Hejčmanová P, Stoklasová L, **Grůňová M**, Brandlová K, Žáčková M. 2017. Preferences of Western Derby elands for macro- and microelements in the Fathala and Bandia reserves: potential key knowledge for conservation. Antelope, Giraffe, Hippo in the 21st Century: Conservation Action in Africa, Czech University of Life Sciences Prague, Czech Republic. Book of Abstracts, p. 43. 19 – 25 February 2017.
- Hejčmanová P, Stoklasová L, **Grůňová M**, Brandlová K, Žáčková M, 2017. Preferences of Western Derby elands for macro- and microelements in the Fathala and Bandia reserves: potential key knowledge for conservation. Antelope, Giraffe, Hippo in the 21st Century: Conservation Action in Africa, CULS Prague, Czech Republic February 19 - 25, 2017, p. 43.
- Hejčmanová P, Brandlová K, Fedorova T, Gloneková M, **Grůňová M**, Kubátová A, Štochlová K, Žáčková M. 2017. Let's Save the Derby Elands in Senegal Western Derby Eland (*Taurotragus derbianus derbianus*) Conservation Strategy Implementation. EAZA Annual Conference, Emmen, Netherlands. Poster presentation.

Educational publications:

**Grůňová M**, Diouck D, , Brandlová K, Hejčmanová P, Jůnková Vymyslická P, Sané M, Žáčková M, Grůňová N. 2015. Les animaux du Sénégal. Derbianus Conservation

**Grůňová M**, Diarra H, Mbengué M, Hejčmanová P, Brandlová K. 2019. Héro de la faune. Derbianus Conservation

**Grůňová M**, Kamara J, Hall S. **2019** Wildlife hero. Akagera Management Company