



# Children's Opinions about the Loss of Nature

Abraham A. Mabelis  
Alterra, Wageningen UR, The Netherlands

## *Abstract*

*A survey was conducted among approximately 400 Dutch schoolchildren (age: 8–16 years) in order to test their feelings about deterioration of the environment and the extinction of species. The majority of pupils answered that they regret the extinction of species more or less, especially popular ones. For a minority it does not matter at all. The proportion of pupils who expressed indifference to the pollution of air, water and soil was 7%, 10% and 13%, respectively.*

*Dying of the forest was taken very seriously by approximately 60% of the pupils; this percentage increased after a slide of a dead forest was shown. A similar result was obtained in respect to the assumed extinction of a common plant species: it was taken more seriously after some information was given.*

*More than half of the pupils predicted a bad future for the Netherlands. However, this pessimistic view can be changed into a more optimistic one by stimulating activities to improve the environment. The fact that most pupils judged their own future positive may indicate that they feel to have some control on the quality of their own life.*

## *Introduction*

Nature is under pressure: natural biotopes are decreasing in area and quality. Consequently more and more species will become extinct. The increasing rate of species extinction is recognised as a serious loss of natural values and a threat to our own survival (Ryan, 1992). Since the ratification of the Convention on Biological Diversity by many countries in Rio de Janeiro (1992), the maintenance of biodiversity has been regularly on the political agenda. Every two years the international debate will be continued. In 2002 the Conference on Biological Diversity was held in the Netherlands (The Hague). Up till now, the debate on conserving biodiversity has mainly been the domain of ecologists and policy makers. The question is whether the need to conserve biodiversity can be understood by people who have hardly experienced nature. Elderly people may have experienced that species which were common in the past have become more rare and have ultimately disappeared from their surroundings, e.g., several plant and animal species which I enjoyed as a boy in the outskirts of The Hague have disappeared and some of them are now on the Red List of threatened species. At that time there was no TV, nor computer. We walked to school or went by bike, played football in the street and experienced nature by building huts in bushes, climbing trees and catching water animals

in a ditch nearby home. Nowadays many teenagers are brought to school by car and spend a great deal of their free time watching TV and playing computer games. Lack of opportunities to experience nature may influence their perception of nature. Do they miss the flower-rich grasslands and the meadow birds of the past? Do they miss the variety of plants and water animals in the ditches? Every new generation will have a more impoverished image of nature than the former one. It is true that most of the youngsters will be informed about loss of nature by the media and schoolteachers (Pawłowski, 1996), but are they worried about it and does it affect their behaviour?

Interest in nature, and concern about its loss, is not only formed by experience and knowledge, but also influenced by the feeling of its symbolic meanings (Myers & Saunders, 2002). Nature can be approached as a resource, as Arcadia or as a symbolic construction (Lijmbach *et al.*, 2002). So, nature loss can be seen as loss of its production value, loss of its intrinsic values and/or loss of its symbolic properties.

If we want to convince young people that it is important to conserve biodiversity we have to find out what kinds of preconceptions, ideas and beliefs they have about environmental issues. Are they worried about deterioration of the environment and loss of nature? As I could hardly find data about this subject in the literature, I tried to get an impression by asking approximately 400 Dutch pupils (8–16 years) for their opinion concerning pollution and loss of nature. I got support from schools in the village where I live, and from schools in a city nearby, to administer a questionnaire on this subject. None of the schools had a curriculum for environmental education.

As the answers may depend upon the age of the pupils, the scores of the age group 8–12 years (elementary schools) were compared with the scores of the age group 12–16 years (secondary schools).

### *The Questionnaire*

About 200 pupils from two elementary schools and about 200 pupils from two secondary schools were given a questionnaire to test how they experience deterioration of the environment and loss of nature. Pupils from the elementary schools lived in a village (approximately 7 000 inhabitants), while some of the pupils from the secondary schools lived in a city (approximately 60 000 inhabitants), situated at a distance of 8km from the village. The environment of both municipalities is rich in nature: river, marshland, meadows and forest. The pupils were given a questionnaire with three groups of questions. They could give their opinion by putting a cross in the column of their choice.

1. How often do you think about
  - pollution of the environment
  - dying of the forest
  - extinction of species
  - an accident in a nuclear power station?

Choice: *never, sometimes or often*

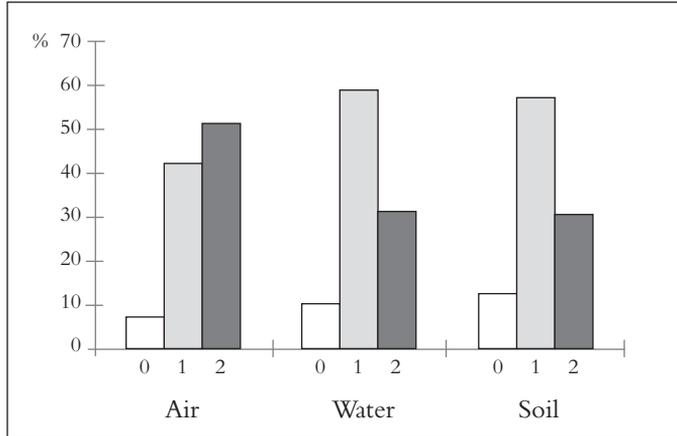
2. How serious is for you
  - water pollution
  - air pollution
  - soil pollution
  - dying of the forest
  - disappearance of natural forest (e.g., tropical rain forest)
  - extinction of species (the last chimpanzee, rhinoceros, barn owl, butterfly, grasshopper, lapwing, orchid, dandelion)
  - accident in a nuclear power station
  - that you will become ill
  - that you will die
 Choice: *not, a little or very*
3. About the future:
  - How do you see your own future?
  - How do you see the future of your country?
 Choice: *bad, good or I do not know*

Finally the pupils were asked to provide solutions to improve the environment. The written responses were open-ended. The completed forms were controlled for reliability by checking for consistency between the answers and solutions given. Only on one occasion was it doubtful whether the questions were answered seriously. It did not affect the result of the survey. The teachers were asked not to influence the children in their answers. Nevertheless the results between the schools may differ as a result of differences in ecological information given by the teachers before the survey. However, a clear difference between the two elementary schools and the two secondary schools could not be proved. Pleasing answers were avoided as much as possible by keeping the questionnaire anonymous. After a period of four months a few questions were again put to pupils of one of the elementary schools after the teacher had given some explanation about possible consequences of the extinction of species. The aim was to find out how strongly children can be influenced in their opinion about loss of nature by means of education. Reported differences between groups are significant ( $\chi^2$  test:  $P < 0.05$ ), unless mentioned otherwise.

## *Results*

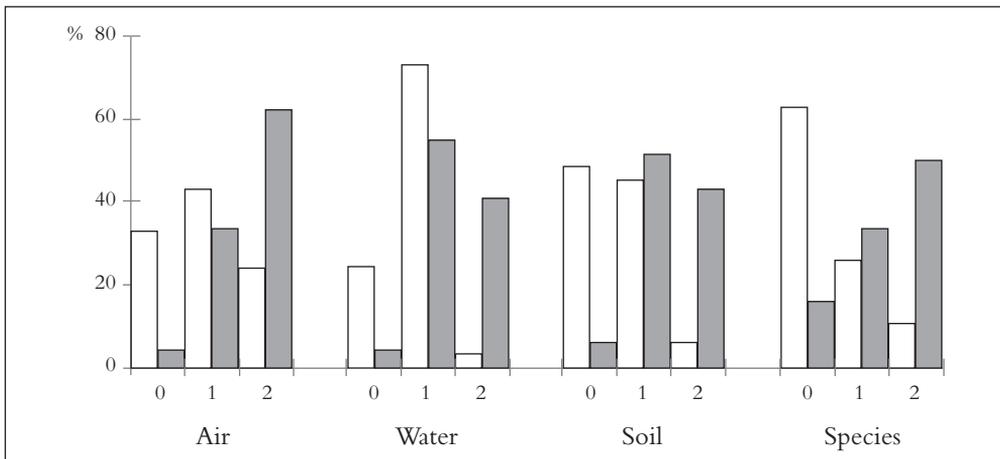
Most of the pupils reported that they thought sometimes or often about pollution of the environment: 71% and 22%, respectively. A small proportion responded that they never thought about it. This agrees with the distribution of opinions about the seriousness of pollution of air, water and soil: only a small proportion of the pupils did not consider it as a serious problem (Figure 1). Air pollution was considered more serious than water and soil pollution. The scores in the age groups 8–12 years (elementary schools) and 12–16 years (secondary schools) did not differ significantly.

**Figure 1.** Opinion of pupils (8–16 years) about pollution of air, water and soil (n = 400): 0 = not serious, 1 = little serious, 2 = very serious



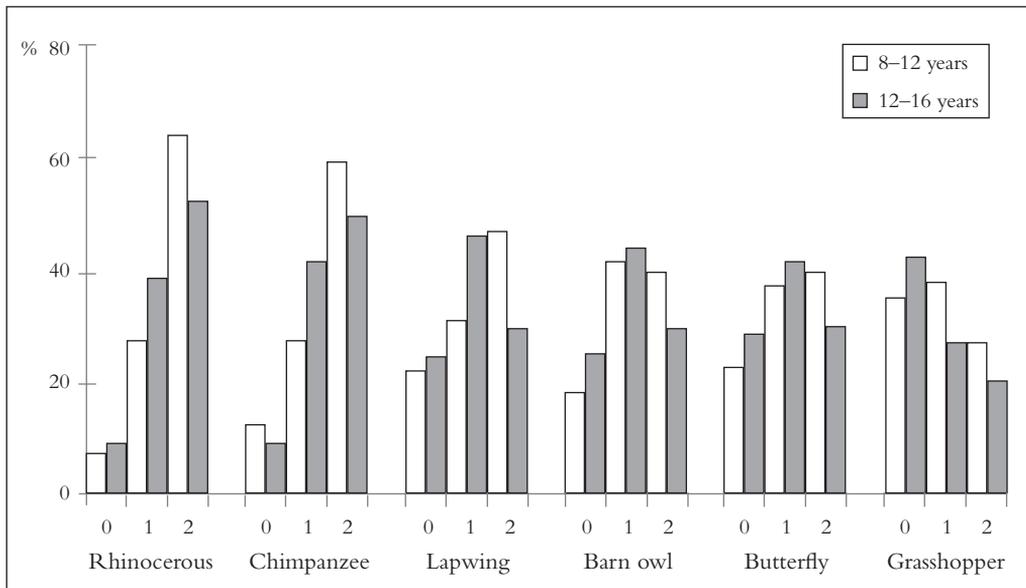
Most children thought sometimes or often about dying of the forest: 59% and 25%, respectively. Most of the pupils judged dying of the forest as very serious (59%), like disappearance of virgin forests (63%). A small proportion (8%) did not mind at all. These children never or only sometimes thought about these topics. They judged air, water and soil pollution and the extinction of species to be less serious than the children who judged dying of the forest as serious (Figure 2).

**Figure 2.** Opinion of two groups of pupils about seriousness of pollution (air, water and soil) and the extinction of (eight) species: 0 = not serious, 1 = little serious, 2 = very serious. White bar: group which did not worry about death of the forest (n=33); grey bar: group which took death of the forest very seriously (n=159)



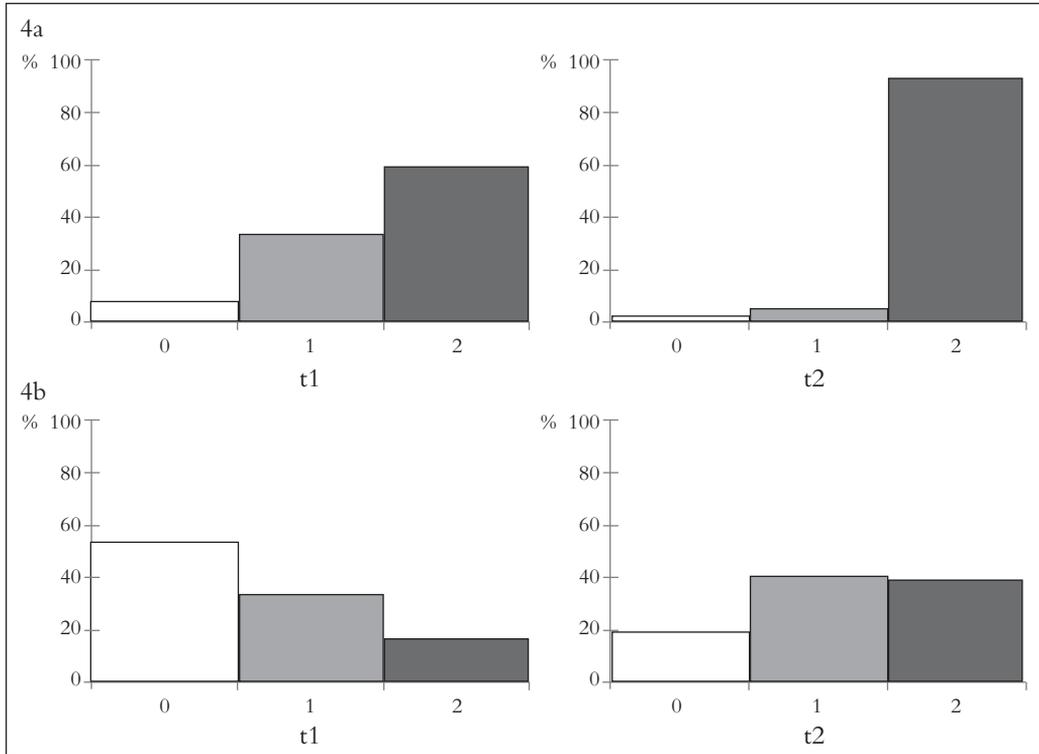
About half of the pupils thought sometimes about the extinction of species and more than one third often (52% and 37%, respectively). According to the given answers, elementary school pupils think more frequently about the extinction of species than secondary school pupils. Some children indicated that they never thought about it (11%). Most of the pupils appeared to regret the extinction of the eight mentioned species more or less, while about one quarter on average did not mind. However, the percentage of indifferent pupils differed per species: from 9% (rhinoceros) to 54% (dandelion). The extinction of large and attractive species, like rhinoceros and chimpanzee, were judged as more serious than a species that is small and less attractive, like a grasshopper (Figure 3). Rarity may also play a role: the extinction of the dandelion was judged as less serious than the extinction of an orchid. According to the given answers primary school pupils may think more often about the extinction of species than secondary school pupils and they judged it in general as more serious, although not significant per species (Figure 3). No significant differences were found between boys and girls in respect of their response to most questions. Only the possible extinction of chimpanzee and butterflies was judged as more serious by the girls.

**Figure 3.** Opinion of (400) pupils about the possible extinction of a few species: 0 = not serious, 1 = little serious, 2 = very serious



Opinions could be influenced by means of visual and oral information. After a period of four months, after giving them information with the help of some slides, children judged dying of the forest and the extinction of species, like dandelion, to be much more serious (Figure 4). The youngest pupils of the elementary school appeared to be influenced more strongly than the older pupils. At first only small differences were found between the two groups with respect to the extinction of species (Figure 3), but after some education the differences became significant.

**Figure 4.** Change of opinion of pupils (8–12 years) about death of the forest (4a) and extinction of dandelion (4b) before (t1) and after (t2) a slide was shown: 0 = not serious, 1 = little serious, 2 = very serious

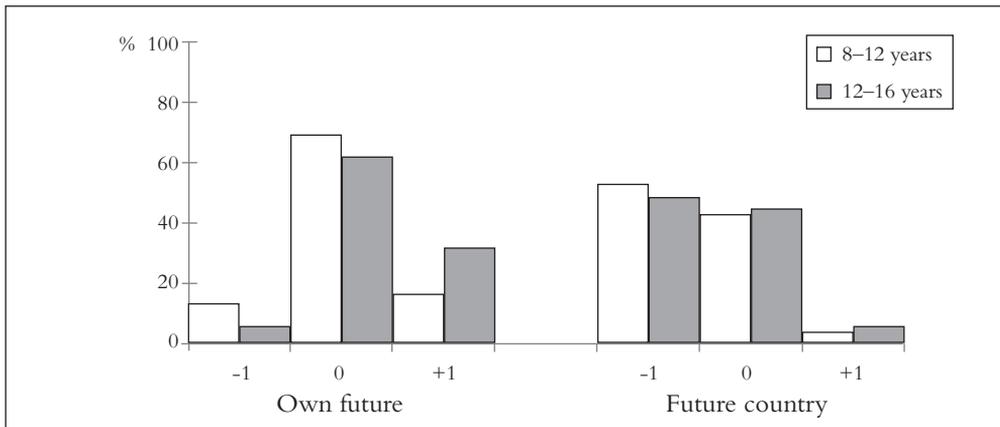


Most children were rather pessimistic about the future of their country: about half judged the future as bad and only a small proportion as good. Most of them had no clear opinion about their own future, but the judgment was more frequently good than bad (Figure 5). Pupils from the elementary schools considered their own future to be worse than did pupils from the secondary schools. They also thought more often about environmental pollution, dying of the forest and the extinction of species. In respect of fear for getting ill, for death and for an accident in a nuclear power station no differences between age groups were found.

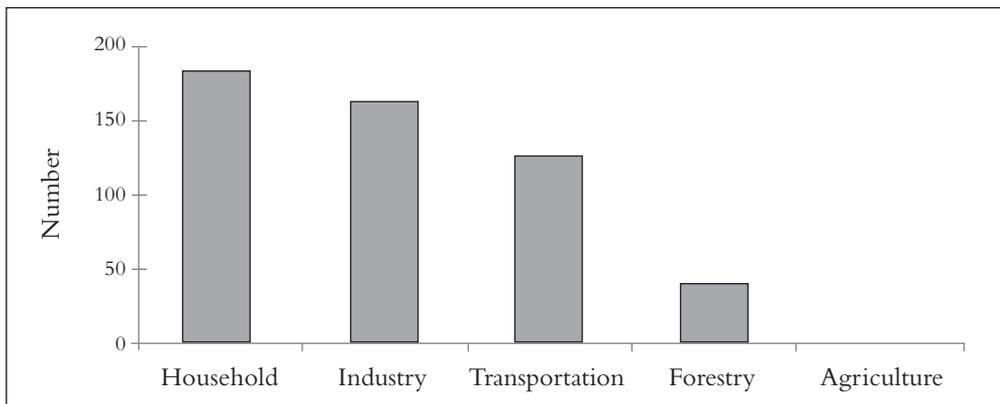
Most of the elementary school pupils (70%) and half of the pupils from the secondary schools responded to the request to give suggestions to improve the quality of the environment. Most of the suggestions regarded measures in the household (Figure 6): decrease the amount of waste, no dumping of rubbish in nature, recycling of materials, segregation of waste, and less use of plastics, packaging, energy and water. Many measures were suggested regarding industry and traffic. Moreover, suggestions were given in respect to ecologically-based forest management, increase of nature areas, and the provision of more and better information about nature and the environment at school. Only one out of approximately 400 pupils gave a suggestion concerning agriculture, namely to decrease the amount of animal manure which is spread regularly on

agricultural land. Most suggestions given were source-oriented (e.g., less use of private cars) and about 40% were effect-oriented (e.g., stimulating use of catalytic converters for cars).

**Figure 5.** Judgement of the future by (400) pupils: -1 = bad, 0 = I do not know, +1 = good



**Figure 6.** Number of suggested measures for improving the environment, classified in categories; n = 280 (8-16 years)



## Discussion

It is important to know if young people are concerned about the extinction of species as they provide a bridge to caring about the natural world in general, especially those species which offer opportunities for interaction and species which have a symbolic meaning (Myers & Saunders, 2002). It is obvious that results of a questionnaire, administered to 400 pupils from four schools, may not produce generalisable results, particularly not to children from another social environment. However, the outcome of this study reflects similar results of a translated questionnaire which was administered to pupils from a few schools in Poland (13-18 years)

and the results of a similar questionnaire which was administered to pupils of seven schools in the Netherlands (Verboom *et al.*, 2004). Together, these results provide some insight into the opinions of European schoolchildren (8–16 years) about deterioration of the environment and loss of nature.

### Involvement

About 10% of the pupils were indifferent in respect to a possible extinction of rhinoceros and chimpanzee. The proportion of pupils which did not mind about the extinction of barn owl, lapwing, butterfly or orchid varied between 23% and 35%. The percentages of indifferent pupils are rather high if the popularity of the species is taken into account. A survey undertaken by Both (1997) among adults was much more favourable for animals, despite the fact that the question referred to unpopular animals, only 9.2% of the 1 000 adults surveyed judged that ‘... nature can do without species like midges, wasps and flies’; the rest did not agree with the statement. An indifferent attitude can be partly explained by egocentric motives, as appeared from the statement of a sixteen-year-old girl: ‘I don’t care if animals become extinct, because animals don’t think about me either’.

Pupils from the investigated secondary schools think less often about environmental pollution, dying of the forest and the extinction of species than pupils from the primary schools. The cause may be that other problems require more attention during puberty. Margadant-van Arcken (1990, 1994) obtained a similar result. She argued that young people (13–18 years) may hide a possible interest in nature, because it is not popular in youth culture. Indifferent responses are not alarming if they are not the result of an indifferent attitude and can be changed by giving relevant information. It was therefore possible to decrease the number of young pupils who judged dying of the forest as not serious (from 8% to 1%) by showing a slide of a dead spruce forest in South Eastern Poland (Figure 7). They also judged the extinction of species as more serious. However, a greater concern does not imply a greater emotional involvement and a less materialistic attitude



**Figure 7.** Many children judged dying of the forest more serious after seeing this photo. (National Park Karkonosze in SW Poland)

towards nature. Species can still be seen as useful or harmful without any feeling for their intrinsic value. A pupil from a primary school in Italy wrote for example: ‘I like the pig most of all animals, because you can take everything out of it, like ham, pork, sausage, black pudding, lard and even a tooth brush’ (d’Orta, 1991).

Most pupils judged air pollution to be more serious than water and soil pollution. This could be explained by the fact that they know that inhaling polluted air affects health directly. It is also

possible that air pollution is seen as the main cause affecting the health of forests: pupils who judged dying of forests to be serious, judged air pollution to be much more serious than the group which did not care about dying of forests. These pupils also judged the extinction of species to be more serious.

The majority of the pupils judged the extinction of species to be more or less serious. Pollution of air, water and soil has a negative effect on the survival of species, but surely not all youngsters will see this relationship. A relationship between environmental quality and the survival of species was rarely mentioned in their written comments. Most of them related the word 'environment' with visible pollution, like rubbish in the fields. In a recent survey a majority of pupils gave priority to cleaning areas from waste in order to protect nature (Verboom *et al.*, 2004). Another investigation showed that youngsters hardly see a relationship between their (biotic) image of nature and their (a-biotic) image of the environment (Margadant-van Arcken, 1994).

About half of the pupils have a pessimistic view about the future of their country and a minority has an optimistic view. No significant difference between the opinion of the youngest and oldest age group was found. Other investigations gave a similar result. In Salzburg (Austria) approximately 300 schoolchildren (14–16 years) were asked to make a painting of what they saw while making an imaginary journey in the future. It appeared that about half of them (55%) had a pessimistic vision of the future and about a quarter had an optimistic vision (Unterbrunner, 1991). Barraza (1999) asked approximately 740 schoolchildren (from England and Mexico) to make a drawing of what they saw after making a long journey with a space ship and visiting the earth again after 50 years: about half of the pupils (54%) made a pessimistic drawing. They thought that the world would be in worse shape after 50 years. Australian pupils (from 12 schools, aged 16–17 years) were also generally pessimistic about the future and felt powerless to do very much about environmental problems (Connell *et al.*, 1999).

The question arises if loss of nature quality may be one of the causes for such a low percentage of optimists. Analysis of the data shows that a negative expectation of the future is related to the degree to which environmental pollution and loss of species are regretted, while no relation was found with fear of illness or death. In Unterbrunner's study (1991) a great majority of the youngsters (80%) draw nature or the environment into their vision of the future, while the teacher had avoided mentioning these subjects. A more recent study indicates that many pupils expect that the quality of the environment and nature will decrease in the next 20 years. Nearly half of the examined pupils judge natural forests as seriously threatened (46%) and 41% as threatened (Verboom *et al.*, 2004). As news about decreasing vitality of forests probably may have a negative effect on the expectation of children about the future (Unterbrunner, 1991), pupils should be given also some positive news, e.g., that modern forestry is no longer focussed on wood production, but on the sustainable use of the forest as an ecosystem.

A view about the future can also be influenced by rare but dramatic events, like the accident at the Chernobyl nuclear power station (1986). Such events may have a greater impact on the expectation of the future than regular events as pollution of the environment (Slovic *et al.*, 1979; Kushnir, 1982). However, no relation could be found between a negative expectation of the future and their judgement about the seriousness of an accident in a nuclear power station. The

pupils thought significantly more often about environmental pollution and the extinction of species than about an accident in a nuclear power station. However, they judged an accident in a nuclear power station to be more serious than water and soil pollution. In order to find out if distance to Chernobyl has an effect on the opinion of children, the inquiry form was translated and presented to scholars of Poland (Pozna, Warsaw) and White Russia (Minsk). It appeared that pupils judged an accident in a nuclear power station more serious the nearer they are living to the source of nuclear fall out (54%, 63% and 90%, respectively).

### **Reactions to the loss of nature**

Information about environmental pollution and the extinction of species can be threatening, especially for children. The evoked anxiety can be limited to some extent by repelling information (Unterbrunner, 1991). Four such repellent reactions can be distinguished from the remarks and statements pupils made on the survey form:

*Selection of information.* When I asked youngsters during a school excursion in the Polish National Park Karkonosze, about their opinion about death of the forest, it appeared that they did not realise that they had been walking the whole afternoon through a dead forest. They saw it (to their surprise) when I asked about it. Often, we don't see what we do not want to see. Another example of selective observation is the fact that among more than 400 suggestions by Dutch pupils for improving the environment only one concerned agriculture, while it is well known that modern forms of agro business, as practised in the Netherlands, is one of the main causes of the pollution of air, water and soil and the local extinction of species. The effects of overdoses of animal manure on the land will be familiar to children from a village.

*Indifference.* Some pupils argued that loss of nature cannot be prevented as most politicians are materialistic and not interested in nature conservation. I got the impression that negative information about the state of nature will not be denied, but does not affect their feelings: loss of nature will not be experienced as painful. A feeling of powerlessness can develop instead. Such a feeling can lead to indifference and dullness. Environmentally friendly behaviour cannot be expected of those children, as they have the feeling that nothing will help.

*Trivialisation.* In the study it seemed that the extinction of species will not be denied, but will be disregarded with the remark that species extinction also occurred in the past and that enough species will remain. For many children reality is less alarming than the images that are evoked by announcements about the effects of environmental pollution and the fragmentation of habitats. This may lead to the conclusion of some older pupils that the announcements are exaggerated. Trivialisation of negative effects is easier if the effects are not visible immediately. The chance that an undesirable incident will occur is generally judged to be lower and less serious as it takes a longer time to become visible (Hendrickx *et al.*, 1993). This may be also the case if the effects take place far from home. Local extinction of species is not visible in an environment where all vulnerable species have already disappeared. The question about the seriousness of dying of the forest (distance in time) was answered by 41% of the Dutch pupils as not so serious, while the question of the seriousness of disappearing virgin forests (distance in space) was answered by 31% of the pupils as not so serious. These pupils do not see loss of nature as a great problem. Even the slightest improvement of the environment is sometimes mentioned as evidence that all environmental problems can be solved.

In addition the success of measures to protect a few species is sometimes used as an argument that all species can be protected. These pupils don't worry about the local extinction of species: if it is serious enough, a solution can be found. It seems that announcements about loss of nature will be assimilated mainly rationally by these pupils and that feelings are set aside.

*Transforming information.* About environmental pollution and loss of nature can be transformed by the pupils to fit in their own world image. One of the pupils wrote, for example: 'it may be that some species disappeared, but on the other hand new species were found. So I don't believe that the number of species is decreasing'. In some extreme cases information was transformed negatively, which may even lead to the conviction that ultimately everything will be lost and that nothing can be saved. A few remarks of children may illustrate this: 'I cannot see a great future, as the world will be irreversibly destroyed' or 'I don't see a solution. The world is already far too poisoned' or 'We have to make Mars inhabitable to escape when the world has become unliveable'. Life seems to be disappointing and senseless. Negative information can be used to keep this image. The certainty of future doom is preferred to the uncertainty of a changing world, as a pupil from an elementary school in Naples (Italy) wrote: 'The end of the world is nicest for me. I am not afraid, because I will be dead after 100 years' (d'Orta, 1991).

### **Implications for environmental education**

Several authors argued that an environmental education program that does not provide young people with nature experiences is likely to fail (Huitzing, 1989, among others). Without nature experiences people will not come to appreciate and value nature and consequently they will be less willing to preserve it. It is also argued that people who live in a severely polluted, urbanised world will be motivated to take action to improve their environment. By focussing education on environmental problem solving pupils may become aware of the value of nature (Gigliotti, 1990). Prior experiences may well influence the way phenomena are perceived and interpreted. People actively construct their own meaning of the news in an attempt to make sense of the world. Transformation of unpleasant news can be prevented by giving threatening information in small quantities. Moreover, the situation should not be represented as more serious than it is. Development of guilty feelings should be prevented, e.g., by trying to provide proper understanding of the problems. In a balanced situation not only can loss of nature be observed and acknowledged, but also the uncertainty and anxiety evoked. Acknowledgement can be an important step to dealing constructively with the evoked anxiety (Unterbrunner, 1991). Anxiety of children about decreasing quality of the environment can be counteracted by stimulating them to improve the situation in their own environment. A pessimistic view about the future of their own country can then give way to a more optimistic view about the future of their own environment. It will increase the chance that the negative effects of own behaviour on the environment can be understood and that environmentally friendly behaviour will be practised. Connell *et al.* (1999) underline the important role schools have to play in teaching 'a curriculum for hope' in order to break 'action paralysis'. Also Wals (1994) underlined the importance of gearing education towards substituting feelings of apathy and 'powerlessness' with the feelings that one, be it as an individual or in a group, indeed can make a difference. The fact that most suggestions to improve environmental quality concerned measures in and near home indicates some willingness to

decrease the own contribution to the deterioration of the environment. The feeling of the pupils that they have some control on the quality of their own surroundings may explain why they were more optimistic about their own future than that of their country. The children therefore have more confidence in making their own future. A similar result was found by Verboom *et al.* (2004). Contents that intersect with the life world of the pupils are recognisable and therefore motivate them more than contents that are far removed from their everyday life. Contents that do not intersect with the pupils' life world require guidelines that will help the pupils and the teacher to make these links throughout the learning process (Lijmbach *et al.*, 2002).

In this survey the following possibilities were mentioned as an own contribution to a proper environment: leave no waste behind in the street and the forest (17%), make less use of the car (15%), do not use a private car (11%), separate waste for recycling (13%), produce less waste (4%), use less energy (2%), use less water (1%) and help actively with the management of the landscape (1%). Throwing away rubbish in nature appeared to be a dominant theme, as was found also by others (Wals, 1994; Barraza, 1999; Connell *et al.*, 1999; Verboom *et al.*, 2004). The (minor) visible effects of environmental pollution attract more attention than the (major) invisible affects of more anonymous sources.

However, the suggestions mentioned above will not lead automatically to environmentally friendly behaviour. Whether the youngsters will follow their suggestion that it is better for the quality of the environment to use the car less (or not at all) at the time that they own a car is questionable. A notion of the quality of the environment and the value of nature is an important, but not a sufficient condition for the willingness to help to improve situations. The willingness to behave in an environmentally friendly way is largely dependent on own efforts and the expected effectiveness of the contribution. So, it is easier to activate people to separate own waste, than to activate them to travel by public transport instead of using their own car. The advantages of using a private car are more clear than the own contribution to the collective disadvantages of all car users. Consequently, many owners of a car will underline the necessity of using their own car and underestimate negative effects, rather than using their car less frequently (Steg, 1996). Very often social advantages of environmentally friendly behaviour can be shown only in the long term if many people follow the rules, while the personal advantages of environmentally unfriendly behaviour can be noticed immediately. The opposite is the case in respect of disadvantages: the personal disadvantages of environmental behaviour can be noticed immediately if few people follow the rules, while the social disadvantages are only observable in the long term (Hendrickx *et al.*, 1993). However, this should not be allowed to lead to cynicism and be used as an excuse to disregard education about nature and the environment. Parents, schoolteachers and others involved in the education of children should not only show possible negative effects of behaviour for the environment, but also possibilities for a positive contribution. The number of children who show indifference with respect to the quality of the environment and values of nature, should be reduced to zero, as it is important for everybody to maintain a healthy environment and a high level of biodiversity. Therefore, nature should be given more attention in schools, as some pupils asked for. More than half of 400 pupils (15–18 years) indicated that little attention is given to nature in schools and three quarters indicated that little or no attention is given to this topic at home (Verboom *et al.*, 2004). Schoolteachers

should explain why the seriousness of pollution depends on its impact and not on the medium involved and why it is important to prevent the extinction of all species, regardless if they are popular or not. In order to make children more aware of the importance of nature conservation it will not only be necessary to explain the relation between society, the environment and nature, but also to support this knowledge by direct observations. Plants and animals are always at hand, even in big cities. Own experience with animals and plants has potential to teach children how to treat them. However, creating new experiences only can lead to conceptual change if the learner sees the relevance of the experience in achieving a certain aim (Hasweh, 1986). Information (know what), experience (know how) and awareness (know why) are important to develop an attitude of respect towards nature (care why). In this way environmentally friendly behaviour can be promoted. Although young people are generally more receptive than adults, it will be most difficult to promote environmental behaviour in children who are indifferent to deterioration of the environment and loss of nature. If this information will be presented with environmentally friendly alternatives for behaviour, children can learn to make responsible decisions. It may stimulate cooperation with others to find solutions to improve environmental quality and to maintain nature values.

### *Notes on the Contributor*

Abraham Mabelis studied biology at Leiden University (specialisation: ecology and ethology). During the next 20 years he worked as an ecologist at the State Institute for Nature Management. At the moment he is working at Alterra: the main Dutch centre of expertise on rural areas and water management (approximately 600 employees). His expertise: (landscape) ecology, nature management and environmental education. Email: bram.mabelis@wur.nl.

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