**International Alliance of Protected Areas**

**Operation Guide Series**

**(For Protected Area Managers)**

**Operation Guide for**

**Environmental Education in Protected Areas**



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**International Alliance of Protected Areas (IAPA)** was proposed by Changbai Mountain National Nature Reserve of China in 2013. With strong support of Jilin Provincial Forestry Department and Changbai Mountain Conservation and Development Management Committee, IAPA was officially established in 2014 and affiliated to the International Society of Zoological Sciences (ISZS). It unites protected areas (PA) in the world to promote coordination, collaboration and cooperation among PAs at national, regional and international levels; promote species surveys and monitoring, trans-regional conservation, and mitigating the impact of global climate change on biodiversity; strengthen conservation publicity and education, explore friendly development strategies in PAs and surroundings, and promote combating environmental crime at site. It becomes a platform for improving management effectiveness of PAs to achieve the goal of harmonious development between man and nature. The first five IAPA annual meetings were held in Changbai Mountain, Shennongjia and Tangjiahe national nature reserves of China. By September 2018, there are 93 PA members (27 from outside of China).

**IAPA Operation Guide Series** are especially designed for PA managers, and kept short, practical and linked to the best and most recent guidelines in the world. It will be reviewed and updated constantly along with practices. Revisions are welcome and suggestions please send to: cbm\_iapa@126.com

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**The operation guide is prepared by following organization:**

**The Global Protected Area Friendly System (GPAFS)** was initiated in 2013 by the task force of Institute of Zoology, Chinese Academy of Sciences and encouraged by the 6th World Conservation Congress, to bring together scientists, entrepreneurs, civil organizations, and the public to support, promote and participate in new production models that are beneficial to nature conservation in and around PAs, to stop the decline in global biodiversity, and to ease the biodiversity loss crisis that threatens humanity’s safe operating space. More information found in [www.gpafs.net](http://www.gpafs.net).

**Tangjiahe National Nature Reserve** is the main habitat of the giant panda in Min Shan mountain range and located in the world’s hotspots for biodiversity conservation. It was established in 1978 and joined the world “man and biosphere” reserve in 2009. There are 430 species of vertebrates, with 72 national key protected animals, over 60 pandas, over 1000 golden monkeys and over 1200 takins. There are 2422 species of plants with 12 are national key protected plants. For more information: <http://www.tjhnr.cn/>.



**Operation Guide for**

**Environmental Education in Protected Areas**

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Foreword

With the rapid growth of population and the excessive use of natural resources, global environmental problems have become increasingly prominent, seriously threatening the well-being of human beings and the sustainable development of society. Increasing awareness and promoting active participation among the public are fundamental to solving environmental issues. With expanding urban areas and an increasingly rapid pace of life, people in cities have fewer opportunities to get in touch with nature. In addition, pressure from work and study, shrinkage and simplification of urban green space, and increasing dependence on various electronic products lead to a series of behavioral and psychological problems, such as nature deficit disorder. Environmental Education (EE) is an important means to solve these problems. EE could be implemented both inside and outside of the protected areas, and this guidelines will highlight the significance and recommended practices of EE inside protected areas. The rich flora and fauna resources and diverse ecological landscapes make protected areas (PAs) natural classrooms for environmental education activities. At the same time, compared to other environmental institutes, PAs provide EE characteristics of strong local identity to conservation. EE in PAs have the potential to bring far-reaching influence on local schools and communities, support the overall environment of the surrounding areas, and play a regulatory and supervisory role in the conservation of the protected area.

1. Importance of environmental education to protected area management

1.1 Definition of Environment Education (EE)

Environmental education can be defined as a process directed at creating awareness and understanding about environmental issues that leads to responsible individual and group actions. Successful environmental education focuses on processes that promote critical thinking, problem solving, and effective decision-making skills. EE utilizes processes that involve students in observing, measuring, classifying, experimenting, and other data gathering techniques. These processes assist students in discussing, inferring, predicting, and interpreting data about environmental issues (UNESCO 1978; KACEE 2018).

1.2 Principles for environment education in protected areas

The goal of PAs is to conserve ecosystems and their ecosystem functions and services, which provide a safety net for the survival and safety of human species. EE carried out in PAs should be planned and designed with such goals and principles in mind (UNESCO-UNEP 1976; UNESCO 1978; Tian et al. 2011; Ministry of Environmental Protection of the People’s Republic of China et al 2016).

1. Conservation principle. The EE activities in PAs should put the conservation of the ecological environment at the first place. Conservation should be favored if conflict between conservation and educational activities arises. For example, the number of visitors could be limited when environmental resources are at risk of being exploited.
2. The objectives of environmental education. EE should educate the public to be more aware of the importance of a clean environment to human survival, environmentally friendly options, enrich the public's personal experiences of the natural environment, and foster the public's appreciation for the natural environment.
3. The scope of EE should be thorough, raising environmental awareness among the public, improving the public’s environmental knowledge, and cultivating environmentally-friendly behaviors.
4. Relevance to local conditions calls for educational activities to be founded on local conditions and existing environmental problems, based on actual conditions and focusing on current environmental issues.
5. Building cooperation. Close connection with local schools, communities, and government agencies should expand the participation of these agencies and strive for long-term, standardized and sustainable EE.
6. Comprehensive principle. EE should be broad and comprehensive, so it can cater the needs of people with different backgrounds, interests and age groups. All natural and human factors in conservation can be used as materials.

1.3 The significance of carrying out environmental education in protected areas

EE should be a basic responsibility of PA management, because it is of great significance for biodiversity conservation and public participation (Swemmer et al. 2017).

The diverse natural phenomena in PAs provide rich materials for EE that can provide the public more opportunities to understand the PA. EE activities are beneficial to promote exchanges and maintain relationship between various stakeholders, and make PA conservation work efficient and sustainable.

EE can improve public understanding of PA’s conservation work, raise public awareness of environmental protection, promote the public's recognition of ecological conservation, promote the environmentally friendly behaviors, benefit conservation work in the PA, and indirectly benefit the local natural environment.

The participation and support of local schools and communities can help monitor the ecological environment in the PA, and supervise and discourage infractions that damages the environment.

2. Overall plan for EE in protected area management

2.1 Understand the status of EE and relevant laws and regulations in the protected area

It is essential to understand the current EE facilities and activities in conservation, integrate existing EE resources and platforms, and summarize the geographical characteristics, biodiversity characteristics and related management regulations of the PA. This understanding provides the foundation for developing EE plans specific to the PA.

2.2 Development of the overall goal and the objectives

The EE carried out by PA should focus on the mission of the PA, such as species being conserved, the ecosystem services (e.g. clean water and clean air provided), environmental problems faced, laws and regulations related to the environment and species conservation, monitoring of the quality of water and air, and research being carried out. It should also develop targeted, themed and appropriate EE plans to meet different needs of schools, communities and other groups (Redman et al. 2017).

Based on these considerations, the overall and annual goals of EE and the measurable indicators included in each target should then be developed. The overall goal should be long-term and guiding. For example, the overall goal could be: “to improve the environmental awareness of the local public, improve the participation of local schools and community environmental conservation, and improve the quality of the surrounding ecological environment”. The evaluation indicators for the overall goal could be: “the PA Eco-environment Museum will be built within 10 years, the number of visitors in the 10 years will exceed 100,000, and the \*\*PA EE Code and Work Manual will be developed and improved within 5 years.”

The annual goal should adhere to specific principles and should be short-term and operable. For example, the annual goal could be: “to promote the hot topic of the year, increase public awareness of protected species in the PA, and focus on enhancing the natural experience of young people in school”. The evaluation indicators could be: “to organize 100 youth natural experience activities, hold 50 environmental conservation lectures, and publish 50 EE articles”. Each goal needs a list of plans to achieve the goal, timeline, deadline, person or agencies in charge, and so on.

2.3 Educational methods

Once you have set your goals, you can determine what kind of educational approach you will take to achieve them. Generally, PA EE is divided into two broad categories, environmental education inside PAs and environmental education outside PAs (Redman et al. 2017).

Environmental education inside PAs is based on the natural resources in the PA, and the EE organized in a PA are mainly tours in the PA, exposing visitors to experiencing nature, popular science communication and science camps.

Environmental education outside PAs can include visiting schools or communities to conduct EE. It can be in the form of lectures, nature-themed crafting or environmental stewardship activities. School activities are also known as formal EE and involve cooperating with schools near PAs to incorporate developed EE courses of PAs into the school curriculum to improve students’ environmental stewardship.

Activities for communities are known as informal EE activities, involving communities in addressing social and ecological challenges, and conducting EE for stakeholders including farmers, indigenous leaders, landowners, women, and youth. The main objective is to raise awareness and share information about conservation issues, thereby gaining the community’s support and participation in conservation.

2.4 Annual activity budget

An annual activity budget is essential for the smooth development of EE in that year. It requires determining anticipated costs and benefits of all aspects and creating an appropriate budget for the specific education program drawing on information from previous years.

2.5 Environment education equipment management and personnel training

Integrate the existing activity facilities, add new equipment to facilitate the activities, and assign staff in charge of managing and maintaining them.

Train the personnel who conduct nature education in protected area, draft a training plan based on the annual goals, and gradually establish an EE talent team for the protected area.

2.6 Monitoring and evaluation

Formulate a comprehensive monitoring and evaluation plan to ensure the smooth achievement of the objectives, correct any deviations and deficiencies in the EE program over time, and lay the foundation for the subsequent plan.

3. Develop infrastructure for environmental education in protected areas

PAs require some infrastructure planning and construction to facilitate EE activities. Common infrastructure includes signage, displays, routes for educational activities, pedestrian walkways, rest kiosks, toilets, garbage disposal and accommodation facilities. Infrastructure like boardwalks, bridges, viewing platforms should have regular safety inspections by PA staff (Luneng Green Development Research Institute 2017).

3.1 Signage

Use various signs and posters to provide event participants with basic information. Other information could include the best routes and activities recommended based on season, weather, time and theme, appropriate behavior within PAs, providing basic knowledge about geology, ecology, species and other important topic. Commonly used signboards include the following types (Li & Zhang 2010):

1. Animal and plant description: provide basic information about wildlife, conservation information;
2. Direction and routes: indicate directions and surrounding facilities, characteristics of the terrain, how to find other project points, etc. It lets visitors see where they are, with suggestions of alternative routes.
3. Information about the PA: show conservation publicity and latest updates regarding the PA.
4. Warning signs: dangerous behavior, dangerous animals, dangerous terrain or geological hazards.
5. Display guide: often displayed at the entrance of a certain area to introduce basic information of this area.
6. Interactive cards: allow participants to participate in the process with perception and action.

Guidelines for outdoor information signage include:

1. Avoid attaching notices to living trees. Instead, attach them to wooden structures of boardwalks or concrete posts.
2. Where labels must to be attached to trees, use an extensible chain or aluminum or stainless-steel nails. (iron and copper are detrimental to the growth of trees). Nails should extend long enough beyond the label to allow several years of tree growth and labels should be loose, so they can slide along the nail or move with the wind, etc. Each label should only use one nail.
3. Make sure the font is large enough to read from distances of up to 5m, and the colors used are not too bright (Warning signs, ban cards need to be very eye-catching).
4. Outdoor information boards need to be printed clearly. They need to be waterproof and durable to sunlight, or to be set under eaves. They should also have a suitable angle and height.

3.2 Exhibition facilities

The size of EE facilities should be appropriate to the anticipated annual number of visitors. If the annual reception capacity will exceed 50,000 people, an EE center is justified. If the annual number of visitors will exceed 10,000, an exhibition hall can be set up. If the visitors will be less than 10,000, a classroom can be set up. The EE center can be equipped with halls, multimedia screening rooms, book material rooms, etc., and equipped with facilities such as ventilation, air-conditioning and fire prevention.

3.3 Boardwalk construction

Boardwalks limit the impact of visitors on wetlands or forest floors by keeping them strictly within visitor areas. They also provide safe and convenient pathways for visitors to cross wet areas.

Such structures are costly to build and require regular maintenance. Care must be taken in design and the following points should be kept in mind.

1. Surfaces get slippery, especially in wet weather. Ways to reduce slipping include placing wire mesh over sloping sections, adding strips of rough nonslip sheeting, and keeping surfaces as dry as possible. One way to speed up drying is to leave gaps between boards of a boardwalk; this also allows light and seeds to reach the ground beneath, rather than creating a damp, shady area underneath.
2. Materials for construction should ideally be wood or stone to blend in the background.. There is no need to design railings that mimic the exact look of wood because it usually does not contribute to the aesthetics. A path is artificial, so it is acceptable that rails, safety chains, etc. maintain their artificial look.
3. Railings should be strong enough to withstand the weight of people leaning against them, to avoid serious injuries from falls.
4. Gravel roadways make noises under human footsteps or vehicles, so these should not be used close to sensitive wildlife. Roads through protected sites should set up speed limit or use speed bumps to reduce the speed.
5. The routing of all roads or paths must be planned in order to minimize the disturbance to wildlife. Keep routes away from breeding areas and feeding areas which can be observed at a suitable distance from hides or towers. (Speed limit 40 km/hr while driving or crossing by the PAs in normal).

3.4 Observation hides, blinds and towers

To get good views of wild species without disturbing them, provide hides, screens and towers at appropriate locations. The main principle of a hide is to allow observers to get a good view outwards but allow wildlife outside the hide to get very little view inwards. The best designs have horizontal slit windows so that it is darker inside the hide than outside, so the observer has a wide horizontal view, but wildlife cannot see more than a narrow dark slit. Pathways can be designed to conceal the movement of the visitors while they access the hides, using fabric screens, planted hedges or structures made from thatch. Pathways leading close to wildlife should be designed to be quiet. The noise of human stepping on wooden boards or gravels could disturb nearby birds. Visitors should be warned to keep quiet at all times when close to wildlife. Towers can be made overlooking good sites or water bodies. They could also serve the duel function of monitoring sites. However, towers are costly constructions and possible safety hazards unless well maintained; they cannot be moved and have only limited views, so any construction should be carefully considered before approval.

3.5 Construction of shelters

The manager should provide adequate shelter for use of visitors as rain shelters, resting points, etc. These should be provided with litter bins and may also have containers for pamphlets, maps, information board or a board reporting recent sightings of wildlife species.

3.6 Low-impact toilets

Overload of human waste in aquatic systems. If a large volume of tourist use of toilets is anticipated, the toilets should be equipped with their own treatment units, septic tanks, and separate drainage channels away from the wetland area, or use a complete removal system. Do not use a chemical treatment system because the disinfectant chemicals used in such toilets are very harmful to wetland biota and ecosystems.

It is also possible to collaborate with farmers around PAs to compost and return waste to the natural circulation.

3.7 Litter collection

The amount of litter going into natural ecosystems is steadily increasing, and is dumped in rivers, ponds and the ocean. This dumping is detrimental to both the aesthetics and the ecosystem of the protected area. Plastics are ingested by wildlife, and netting, fishing lines, lead fishing weights, sharp cans and other debris kill large numbers of aquatic creatures. Most litter does not break down easily and remains a hazard to the environment for many years.

The following actions need to be taken by the PA manager:

1. Ensure that there are adequate litter disposal facilities and that these facilities are emptied regularly to minimize litter impact within the protected area.
2. Each visitor entering a PA could be given a recyclable garbage bag (which could be recycled when the bag is brought out). The visitors should be encouraged to bring the bag with them upon exiting the PA to properly dispose of the garbage;
3. Cleaning litter from roads, trails, river banks or water bodies in the protected site is costly in terms of staff time, but the burden may be reduced if the manager can enroll a volunteer force of school children, youth or adult helpers.
4. Provide incentives for self-cleaning of garbage in the PA, such as giving out coupons for a tour.
5. Promote waste sorting and resource recycling.

3.8 Accommodation requirements

For EE activities to achieve sustaining and concrete results, they need to both educate with the appropriate approach for enough duration, and cultivate environmentally friendly behavior and habits in the daily life of the participants. The EE of PA should be reflected in all aspects of life, including food, clothing, housing and transportation. In addition to the basic food, sanitation, and safety requirements, the accommodation facilities should bear in mind the mission of the PA, provide environmentally friendly facilities and equipment, and support the conservation work in the PA.

Site managers could also consider making full use of the surrounding community accommodation, enabling the community to gain revenue by participating in EE, and become aware of the importance of maintaining their surrounding environment. This will be conducive to the protected area’s conservation work and its partnership with the community.

4. Design content for environmental education and material preparation

4.1 Preparation of environment education materials

The preparation of EE materials mainly includes the following aspects:

**Website**: used to introduce the basic information of protected area, conservation achievements, and main challenges. Also useful for online appointments for EE activities, announcement of EE activities, and promotion of EE activities.

**Maps**: a good map of the protected area is crucial. It is also helpful to have some themed maps, such as hand-painted green maps, topographic maps, and species distribution maps. Electronic maps are very useful for online audiences (such as Dinghushan National Nature Reserve digital map: <http://www.dhs.scib.cas.cn/ydhz/stly_szdhs/>). In some areas, panoramic virtual tours could be created.

**Brochures**: information about the PA’s species expected for each season (e.g. migratory birds, fungi, flowering plants, and animals in hibernation), related activities, notices and publicity of regular activities.

**Species Identification Guide**: an overview of species in the PA (which can be categorized, such as plants, fungi, mammals, birds, etc.) and information for important species (endangered species, key species, flagship species, charismatic species, and culturally important species).

This information can be made accessible from the website, the entrance gate or in the visitor center. PAs can also create mobile applications according to their own situation. Some examples include: Wuhan University's Plant Map App, and Yancheng Nature Reserve App from Yancheng Wetland National Nature Reserve. These apps can be downloaded from the mobile phone software store. They were created by a professional company after basic data and information were gathered.

4.2 Basic information collection

Systematic collection of species information and ecological information in PAs is a fundamental part of EE. This is usually carried out by conservation staff or those engaged in EE activities, through field surveys and literature research. All geological, biological and cultural information relevant to the PA can be used as material for EE. Continuous collection and archiving can effectively contribute to the long-term development of EE programs.

**Geographical and cultural information** includes background information in conservation, such as topography (focusing on areas with interesting biological or geological phenomena), climate conditions, historical background of human settlements and story collection.

**Biological information** includes species identification, activities and distribution of animals and plants, animal migration time, plant flowering time, animal nesting area, and interesting biological phenomena.

**Conservation work information** about the key species for conservation and the respective conservation programs, updates on conservation work, scientific research results from PAs gives EE programs perspectives on the threats to protected area, conservation approaches, scientific research and its results, etc.

5. Develop specific environmental education activity plan

5.1 Development of an environmental education activity plan in protected area

1) Understand the participants and their needs

Knowing the basics of the event participants (such as age, number of participants, etc.) is very important for the design of the event and the choice of theme. For example, an EE activity with the theme of "Autumn in the Protected Area" would include very straightforward activities for second-grade students because they could pick up the colored leaves and various fruits and simple crafts. However, children in secondary schools may feel that there is too little educational content. The same leaf and fruit activities could be enriched by some interesting stories and popular scientific knowledge.

In some cases, in addition to understanding the age range of participants, it is also necessary to understand the very specific needs of some participants. Consider this case: a community nursing home wants to go on a weekend trip to the protected area with some fun little activities. On the one hand, this activity should consider the physical strength of the elderly during route selection. On the other hand, to make the hiking activities more lively and interesting, it should integrate the historical, cultural or scientific information relevant to the route, and design some small, achievable tasks.

2) Develop activity goals and topics

After understanding the basic situation of the participants, the goals and themes of the activities form the core of the entire event design. Although it is not strictly required that each activity clearly lists the goals and themes, this thinking process is important to ensure no deviation from the designed activities and activities.

The determination of the target is based on the type of participants as well as the mission of the protected area. For second-grade students mentioned above, the goal of the school may be to let the children expand their creativity, experience nature and love nature. However, a goal that fits the mission of the PA may be for the kids to pick up the leaves and fruits, and then put the leaves back into the nature, so that the kids are taught to abstain from taking things from nature.

The theme of the event can be diverse and can be formulated according to the environmental factors in the protected area, the category of the conservation species, unique characteristics of the protected area, and incorporate specific activities. Listed below are some common topic types as a reference.

* **Five-senses experience**: This is very effective for children of younger ages. It is also a common method to establish a connection between the individual and the environment based on the most basic body perception.
* **Starry sky and earth**: show the starry sky, geological features, and go deeper into their details, to provoke people's thoughts.
* **The changing natural environment (**wind, snow, etc.): This theme is highly correlated with weather conditions and is highly seasonal. It is also related to the characteristics of PAs. For example, PAs in Northeast China can carry out a series of activities with the theme of winter snow. For PAs in the Yangtze River Basin, the activities could be based on the features and significance of rainy seasons.
* **Diversity of Life**: Focusing on fauna, flora, and fungi, including pandas, sea turtles, antelopes, rhino, tiger, elephant…etc. Such life-themed activities are common in PAs. Examples include reforestation, patrolling, research field work (such as installing infrared camera, sign survey etc..).
* **Art and nature**: Crafting activities will make the whole event more artistic and interesting. For example: nature drawing, making crafts, and so on.
* **Adventures and challenges**: Organize some challenges in the PAs, such as hiking competitions, bird watching competitions, and nature observation festivals.
* **Related to daily life**: for example: Energy efficient living, saving water, reducing food waste, garbage disposal, environmental stewardship, etc.
* **Holiday themes**: Earth Day, Arbor Day, World Water Day, Bird Week, etc.

3) Inspect or develop a route

Before the event, careful inspection of the routes and venues is indispensable to a successful event. It is usually necessary to arrange two inspections. The workload of the first inspection is large. It is necessary to scout out multiple routes at the same time and select a route that is safe and a good fit for the event. Every route should be examined as detailed as possible, and the routes that are not selected could serve as alternative route or routes for future events. The second inspection is usually 2-3 days before the event. This inspection is mainly to confirm whether the road conditions have changed, whether the scientific information boards and potential points of activity are still available. The 2-3 days interval mentioned here could be adjusted based on the weather conditions to be 3-4 days in advance; however, it should be no more than a week because significant change might happen during a week. It is also advisable to not push the inspection till the day before. First, if there are changes on the route, there is not enough time to change the event plan. Second, the last preparation day will involve a lot of communication work and material preparation.

4) Confirmation of road traffic safety and service facilities around the venue

Many of the PAs are large and the activity could be located in various types of areas in the PAs. Activities in PAs almost always involve transportation. Making decisions regarding transportation is also part of the route scouting, but because it is very important, it is presented in a separate point.

Arrange the number and size of vehicles according to the number of people participating in the event. Double check whether the size of the vehicle can pass the fixed route, whether there are dangerous spots on the route, the condition of the mountain around the line, etc.

When the participants are younger, it is necessary to know in advance whether there are service facilities (toilet, rest, etc.), their numbers and locations. To make the event smoother, the educator should set appropriate time and place for break depending on the flow of the event.

5) Determine the duration, content and materials

There are generally several types of activity durations:

* 1.5 hours - equivalent to the duration of a class in the school (this includes the time before and after the event, organizing the group, the temporary break in the middle, etc.);
* Half day / 1 day - involving catering arrangements;
* 2-3 days - weekend or small holiday activities involving catering and accommodation arrangements;
* 7-15 days - continuous camp activities or scientific research activities involving catering, accommodation and maintenance of campground.

In addition, the duration of the event requires PAs and event participants to agree on different topics and requirements.

The content of the event could be very diverse, and it can be designed according to the educational goals and in reference to case studies. For example, in the spring, activities could be designed around the insects on trees. The goal is to let participants know the importance of insects and reduce the aversion to insects through activities. Some insects have just hatched in spring, some have just emerged from the cave. After a quiet winter, these newly emerged plants and animals are easy to attract people's affection and attention. The content can start with the observation of some specimens and interesting stories to trigger the participants’ interest. Then the participants could be encouraged to find and observe newborn insects themselves. Some guiding questions could be designed to provoke thinking, such as about the relationship between these insects, trees, human beings, and the larger ecosystem. In the end, the participants can gain a deeper understanding of one species or a group of organisms and have a small discussion about what could happen if such insect no longer exists etc., the game can be interspersed with some small games about insects (such as guessing the name of the insect, etc.). With such a series of activities, participants' understanding of insects will be greatly improved, and our goals will be achieved.

The materials in natural activities are generally derived from the natural environment, and there are not many requirements for teaching aids, except for specific activities such as labor and scientific experiments. For example, autumn would be a good time for an activity about seeds, because a variety of seeds could be seen everywhere, so a few cards are enough to facilitate collecting and observing these seeds. In addition to basic natural materials, some activities will involve the use of some teaching aids, nature reserves can develop and produce teaching aids according to their own circumstances.

6) Develop an alternative plan

Before the event, in addition to the first plan designed by theme, 1-2 alternatives of the same theme will generally be prepared for use in case of unexpected situations. It is recommended to plan for indoor activities as alternatives in case of bad weather.

7) Budget and staffing plan

The activity budget includes the following aspects: personnel expenses, activity consumable materials costs, transportation and accommodation expenses, activity design costs (pre-examination and activity content design), PA resource maintenance costs, insurance costs, etc.

There are many roles in the activity, usually including:

**Interpretive guides**: The team leader is the core organizer of an event. The team leader is responsible for the overall management of the event. The team's theme and content design are also completed by the team leader.

**Teaching assistant**: Responsible for designing and leading part of the activity, organize the materials, organize the participants of the activities, and assist the team leader to complete the activities.

**Volunteers**: organize event participants, check-in, distribute materials, photography, etc.

**Guest speakers**: For some activities specialized knowledge is important and could be drawn from invited experts. For example, water-themed activities will require an expert with knowledge of aquatic organisms. Having experts and scholars in this field as the highlights or supplements of the activities also improves publicity of this EE activity.

**Photography**: Professional photographers are necessary for activities that require post-promotion, because untrained photographers often cannot find the highlights of the event.

**Logistics**: purchase supplies and arrange accommodations.

**Publicity**: write promotional materials, real-time report, etc.

**Finance**: activity budget, reimbursement, etc.

**Accompanying medical professional**: Medical professionals or trained first responders are important for longer activities, especially those with youth members.

In an event, not all the roles mentioned above are required. Sometimes, some small science activities can be completed only with the team leader and the assistant. Assign roles according to the specific activities to improve the efficiency of the event preparation and implementation.

5.2 Formulation of environment education activity plan outside protected area

The activities mentioned above are all designed and led by protected area. In most cases in real life, the school or community will design and lead the event, while PAs serve assisting function.

Both the school and community's EE activities are in their normal scheduled activities and require conservation staff to provide some professional knowledge and technical support. For this type of educational activity, the school and community will have a fixed theme and detailed planning. PA do not have a lot to prepare for other than arranging staff to be the focal person, reviewing the content of courses and activities, giving tips on safety or environmental stewardship.

For those activities that need PA to participate in the design, please refer to some of the contents mentioned in 5.1. In addition, the activities should be prepared to pay attention to the following points:

1. Establish contact with school community and design courses or activities based on the theme chosen by the school and community;
2. The content of the activity is mainly lectures or classroom classes and can also include some crafting or scientific experiments. Develop content based on the requirements of the school and the resources it can provide;
3. Courses and activities are mostly long-term (also one-off lectures), and attention to the context of the design of the course or activity;
4. Combine classroom theory with outdoor practice. Outdoor experience can start with the surrounding environment in daily life, such as campus and community, and then expand to other environments.

6. Implement environment education activities

There are a lot of potential problems in implementing EE activities. Here are some things that should be noted in the activities.

6.1 Basic principles for implementing outdoor natural activities

No matter what kind of activity, if it is carried out in the natural environment, it will inevitably have an impact on the surrounding environment. This is normal and inevitable; however, outdoor nature activities should strive to minimize such impact and maintain the environment in its original state.

Here are seven basic principles for Leave No Trace (LNT) outdoor activities (The Leave No Trace Center for Outdoor Ethics 2018):

1. Plan ahead and prepare
2. Travel and camp on durable surfaces
3. Dispose of waste properly
4. Leave what you find
5. Minimize campfire impacts
6. Respect wildlife
7. Be considerate of other visitors

These principles are strict, and sometimes quite difficult to implement because the participants might not be used to them. However, the staff of PAs must strictly enforce these principles to achieve the desired effect.

6.2 Emergency and emergency procedures

The relationship between EE activities and the natural environment is very close. During outdoor activities, many environmental factors will lead to changes in activity plans, such as sudden rainfall, occasional animal attacks, changes in personnel or venues, etc. It is important to have an alternative plan and calm down to deal with emergency situations.

1. **Weather effect**

The change of weather has a great influence on the activities in the outdoor nature: the temporary rain and snow weather made outdoor group activities impossible; the original route cannot be made due to factors such as rain; flowers are blown off after a big wind, so the flower-themed event could no longer take place. Most of the times, situations like this will lead to last-minute cancelation or postponement of the activity. If conditions permit, you can also make multiple backup plans under one theme, and gradually accumulate an activity catalogue to facilitate quick response.

For example: a water-themed activity, on a sunny day, you can go to the river bank to do a survey of the water environment, understand the overall ecological situation, and even do interesting scientific experiments and games on the water of different rivers. If it is rainy and the rain is heavy, it is obviously not wise to go to the riverbank. The focus can be shifted to the circulation of local water bodies, water utilization, purification and so on.

1. **Wound treatment and first aid**

Outdoor activities often encounter scratched sharp fall branch plants or bleeding condition, sometimes there will be situations such as a fracture or poisoning, the specific operation may refer to "Field Survival Guide (color),"(Drake 2005).

First of all, we must promptly treat the wounds in a timely manner and calmly organize evacuation if needed. At the same time, we need to make the decision of whether or not to continue the activities depending on the situation. In general, small wounds (slightly bruised and bruised, etc.), especially for groups of kids, should not attract too much attention after treatment; otherwise it will cause anxiety and tension in the whole group. In addition to the basic first-aid skills, the team leader also needs to care for the mental state of the patient. Sometimes a very simple first-aid treatment might cause psychological stress on other members due to excessive tension and uneasiness, which might end up having a big influence on the group activity.

**3) Time change or site change**

EE often has temporary changes in time or changes to the venue. At this time, it is necessary to check whether the alternative plan or change in theme and content is possible, or if the activity must be postponed or canceled. At this time, it is necessary to negotiate with the organizers involved in the activity, and every party should bear their own responsibilities and losses.

6.3 Maintenance of the environment after the event

EE is carried out in an environmentally friendly way, but it inevitably has some impact on the surrounding environment, especially the large number of team activities, so after the event:

1. All event participants clean and maintain the activity environment at the end or end;
2. The things that are taken from nature should go back to it, without taking away or destroying them;
3. Organize volunteer teams to regularly investigate the environmental conditions around the activity route. For example, if human activities have too much influence on the normal activities of other organisms, the route could be temporarily closed to the public.
4. Each route should have a period open to the public and a resting period to minimize the pressure on the environment.

7. Evaluate environmental education outcomes and update environmental education overall plan

It is very important to evaluate the effectiveness of EE activities, to draw insights, adjust plan for future activities and improve the overall impact of the EE program (Peake et al. 2009).

7.1 Assessment of the overall status of environment education activities

Through monitoring and evaluating the EE effect, problems can be found, and experiences summarized, which would be helpful to adjust the EE plan in time and to ensure the realization of the overall goal. The aspects that should be monitored and evaluated include:

1. The number of visitors in the year and whether there is an increase every year when compared to historical records;
2. The scope of influence of EE activities: the number of participating schools and community, and the participation of regions away from the PA;
3. The degree of support in the city or region where it is located;
4. Improvement of the surrounding community environment;
5. The level of satisfaction of the visitor and subsequent support and participation.

7.2 Evaluation of educational approach

There are two criteria that determines the successfulness of nature education activities. One is how much information the participants receive, and the other one is whether the participants will have feedback or participate in the activity again. The effectiveness of an educational approach could usually be determined through the two following methods:

**1) Observation of participants**

The changes in participants' emotions and behaviors during the activity are a measure of the effectiveness of the activity. An interesting activity plus the leader's presentation skills can make a person who was originally not interested to quickly enter learning mode.

Observations: Whether the participants are listening and answering the questions, whether they are participating in interaction, whether there is change in their mood

An important point here is that the same activity will not be loved by everyone. In addition, not everyone will show whether they like the activity. This type of judgment is more applicable to activities with adolescent participants, and it takes a lot of experience to be able to adjust the activities based on the observation of the participants.

**2) Use of questionnaires**

The use of the questionnaire in the activity is also a convenient way to evaluate the effectiveness of natural education. After the activity or at a specific time every week and every month, the questionnaire could be distributed to be filled out. The statistical results of the questionnaire offer insights to some of the participants' ideas. One of the drawbacks of this method is that it requires a high level of participation. This can be combined with some promotional activities for the protected area, or it should have a very good effect with the ticket discount.

According to the survey results, it is very clear which EE activities in conservation are more popular and which ones need to be modified.

The results of the summary need to be reflected in the course or activity schedule in a timely manner.

8. Case Studies

There are some excellent examples of environmental education in PAs on the IUCN Panorama website which will also help the audience for this document. You could visit PNAORAMA and search for “education”(PNAORAMA , solutions for a healthy planet, 2018).

8.1 Environmental education in Kruger National Park, South Africa

South African National Parks (SANParks), of which Kruger National Park is one of 19 national parks, has a long history of EE and mature experience. There are special EE plans in the general management plans of every national park. These plans have a detailed summary of past EE work, and plans for new EE goals, programs, budgets, etc. (Redman 2017).

The Kruger National Park's EE program is very comprehensive, especially in terms of educational goals and the development of educational methods, it is worthy of reference to other protected areas.

1) Formulation of the goal of EE activities in Kruger National Park

Kruger National Park (KNP) is an integral part of the Greater Limpopo Transfrontier Conservation Area, an international conservation system embedded in a treaty between South Africa, Mozambique and Zimbabwe. It is dedicated to providing EE, related outreach programs and facilities to the community, sharing environmental concepts, environmental skills and environmental knowledge, with the end goal of promoting the improvement of social environmental awareness and the development of environmental protection behavior.

KNP’s EE plan involves the formulation of the overall goals and the sub-goals to be achieved by the major EE programs. It involves all the aspects mentioned above and is a good case to learn from.

**The overall goal of EE in KNP is**: to build and broaden a strong, long lasting conservation constituency for greater environmental sustainability by fostering positive stakeholder relationships, establishing co-leaning opportunities through EE and awareness, facilitating access to tangible and intangible conservation benefits and ameliorating negative attitude towards conservation in society.

**Environmental education and outreach objective**: to use environmental education and outreach programs and facilities to build relationships that promote pro-environmental attitudes and actions by creating awareness, sharing knowledge and developing skills.

**Stakeholder relationships and engagement**: to build positive relationship with various stakeholders by facilitating effective engagement and linkages in order and share conservation benefits through partnerships with government departments, NGO'S, municipalities, communities, Traditional Councils, CBO's.

**Promoting access**: to qualify for free access to the park by participating in EE activities, and to increase the number of members of the public entering the park, especially in neighbouring communities, and create awareness and appreciation for the value of KNP and conservation to broader society e.g. free and subsidized entry permits, school groups, South African National Parks (SANParks) week, Traditional Council permits, cultural site visits, meetings, community Wildcard.

**Amelioration of negative attitude**: KNP mitigates negative impressions of conservation among the public by promoting the understanding of the significance and value of environmental stewardship.

KNP has also set several activities for the following goals:

* Raise awareness about the environment, with a focus on the system of national parks that represents both natural and cultural resources
* Promote the use of parks as educational resources, while allowing access specifically to previously marginalized people
* Provide interactive programs that will assist learners to form their own values, and attitudes towards the environment
* Allow learners to acquire the necessary skills to solve environmental problems
* Assist learners to contribute in solving environmental issues while participating in park activities and to use the park environment as their laboratory for environmental learning
* Assist learners in networking and the sharing of knowledge, skills and experiences with others
* Enhance the experience of visitors to SANParks through environmental interpretation and education to encourage repeat visits
* Increase the number of and broaden the range of school groups receiving a quality learning experience in National Parks
* Encourage local communities to understand, appreciate and support the conservation work of SANParks

These targets are highly specific and involve a wide range of topics, ranging from publicizing the park and deepening participants experience, to solving practical environmental problems, to balancing both conservation and education.

2) EE Program in Kruger National Park

The categories of EE activities in the Kruger National Park are similar to those mentioned above. They are classified into projects in PAs and projects outside PAs targeted at involving the community and spreading environmentally friendly actions. Each part is divided into two parts: course study (based on formal education courses to enhance the study of the content of the national curriculum) and non-course learning (based on educational programs to strengthen study outside the national curriculum). There are detailed planning and course content. This model can also be applied when developing educational programs.

8.2. Brazilian Marine Turtle Conservation Project Case

The National Marine Turtle Conservation Program (TAMAR: http://www.tamar.org.br/) was established by the Brazilian government in 1980. TAMAR has achieved great success: it successfully stabilized the population of sea turtles, and, more importantly, it changed the attitude of local residents and even the entire nation to conservation, making conservation work sustainable and widely supported.

TAMAR works closely with local community, local schools and the government, and their successful EE experience provides lessons for other PAs to learn from.

1. TAMAR-local community cooperation

While PAs rely on the support of local communities, they give back to the communities as well. The most successful thing about TAMAR is that it actively cooperates with local residents. The main EE goals include:

* Improve the conservation awareness of local residents, including the conservation activities in the local community, the educating the importance of sea turtle conservation, and involving local resident in the survey and conservation actions;
* Enhance local residents' conservation skills, including training local residents to use special fishing gear that reduce damage to sea turtles and train local residents to participate in specific actions of conservation sea turtles;
* Local residents benefit from conservation work, including trainings on producing some turtle-related handicrafts to sell to tourists, and visitors who come over for EE activities. These activities can bring income to local residents.

1. TAMAR-local school cooperation

* Make conservation awareness rooted in the minds of young people. In order to raise local residents' awareness of TAMAR, a series of lectures on sea turtles were carried out in local rural schools (for example, lectures on the species of sea turtles, the conservation status of sea turtles, the importance of sea turtles, the conservation measures of sea turtles, etc.) and marine conservation activities. (For example, releasing a newly hatched young turtle into the ocean, etc.).

1. TAMAR-Government cooperation

* Cooperate with the government to strengthen the establishment and amendment of laws and regulations, cooperate with the official media to conduct EE, and publicize the work of conservation.
* Assist the government in the development of new laws and regulations on animal conservation (sea turtles and marine animals) and publicize them to make the new regulations widely known;
* Use the official media (television, etc.) to promote the significance and importance of the work of the Turtle conservation on a local or larger scale, while attracting more visitors.

9. Other useful information

The #NatureForAll movement was formally launched at the 2016 International Union for Conservation of Nature (IUCN) World Conservation Congress in Hawai’i. The movement is driven by a growing IUCN-led global coalition of partners who represent a variety of sectors. It aims to build support and action for nature conservation among people from all walks of life by raising awareness and facilitating experiences and connections with the natural world. Rather than providing a “one size fits all” solution, it aim to foster enabling environments to reduce barriers and connect people with nature in different regions, contexts and realities. For more information: <http://natureforall.global>.

A BioBlitz, is an intense period of biological surveying in an attempt to record all the living species within a designated area. Groups of scientists, naturalists and volunteers conduct an intensive field study over a continuous time period (e.g., usually 24 hours). There is a public component to many BioBlitzes, with the goal of getting the public interested in biodiversity. To encourage more public participation, these BioBlitzes are often held in urban parks or nature reserves close to cities. A BioBlitz has different opportunities and benefits than a traditional, scientific field study. Some of these potential benefits include:

1. **Enjoyment** - Instead of a highly structured and measured field survey, this sort of event has the atmosphere of a festival. The short time frame makes the searching more exciting.
2. **Local** - The concept of biodiversity tends to be associated with coral reefs or tropical rain forests. A BioBlitz offers the chance for people to visit a nearby setting and see that local parks have biodiversity and are important to conserve.
3. **Science** - These one-day events gather basic taxonomic information on some groups of species.
4. **Meet the Scientists** - A BioBlitz encourages people to meet working scientists and ask them questions.
5. **Identifying rare and unique species/groups** - When volunteers and scientists work together, they are able to identify uncommon or special habitats for protection and management and, in some cases, rare species may be uncovered.
6. **Documenting species occurrence** - BioBlitzes do not provide a complete species inventory for a site, but they provide a species list which makes a basis for a more complete inventory and will often show what area or what taxon would benefit from a further study.

Since 1996, the first event was held in USA, there are already many countries have conducted BioBlitzes. For more information on the case in Ontario, Canada: <https://www.ontariobioblitz.ca/>.

Rare is a global leader in using behavior change to achieve long-lasting conservation results. For over 40 years, it has empowered local leaders to inspire community pride in sustainable natural resource management so that people and nature thrive. It finds what works locally and bring it to scale globally—providing a blueprint for building a conservation ethic around the world. Rare turns conservationists into social scientists by training them to research and analyze community motivators and message the need for change in a way that appeals to both hearts and minds. This is then used to inform comprehensive social marketing campaigns --which is called Pride-- that inspire communities, municipalities and even nations to take pride in their natural resources. For more information: <https://www.rare.org>.

One of the world’s most popular nature apps, iNaturalist helps you identify the plants and animals around you. Get connected with a community of over 750,000 scientists and naturalists who can help you learn more about nature! What’s more, by recording and sharing your observations, you’ll create research quality data for scientists working to better understand and protect nature. iNaturalist is a joint initiative by the California Academy of Sciences and the National Geographic Society. Every observation can contribute to biodiversity science, from the rarest butterfly to the most common backyard weed. These findings are shared with scientific data repositories like the Global Biodiversity Information Facility to help scientists find and use these data. It provides species identification guidelines to promote general public involve in observation of species. For more information: <https://www.inaturalist.org/>.

An IDA International Dark Sky Reserve is a public or private land possessing an exceptional or distinguished quality of starry nights and nocturnal environment that is specifically protected for its scientific, natural, educational, cultural, heritage and/or public enjoyment. Reserves consist of a core area meeting minimum criteria for sky quality and natural darkness, and a peripheral area that supports dark sky preservation in the core. For more information in applying or learning more about how to become an International Dark Sky Reserve, click here: <http://darksky.org/idsp/reserves/>.

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References

Drake P G. 2005. The Complete Practical Guide to Camping, Hiking & Wilderness Skills. Anness Publishing, London.

Li XY, Zhang EQ. 2010. Zoo conservation Education Workbook. Beijing Zoo.

Luneng Green Development Research Institute. 2017. On the Way, pp103-105. Science Press, Beijing.

Ministry of Environmental Protection of the People’s Republic of China, Propaganda Department of the CPC Central Committee, Civilization Office of the Central Communist Party Committee, Ministry of Education of the People's Republic of China, Chinese Communist Youth League, All-China Women's Federation. 2016. National Environmental Publicity and Education Work Program (2016-2020).

#Natureforall, IUCN, Switzerland. Available from http://natureforall.global/why (accessed September 2018).

Peake S, Innes P, Dyer P. 2009. Ecotourism and conservation: factors influencing effective conservation messages. Journal of Sustainable Tourism 17(1): 107–127.

PNAORAMA, solutions for a healthy planet, IUCN, Switzerland. Available from https://panorama.solutions/en/portal/protected-areas?keyword=education&solution\_type=All&sort\_by=search\_api\_relevance&sort\_order=DESC (accessed September 2018).

Redman K, Swemmer L, Mmethi H, Machavi J, Mdungasi P, Themba S, Madzutha T, Hlatswayo L, Moate M. 2017. Environmental Education low level plan. Kruger National Park.

Swemmer L, Mmethi H, Twine W. 2017. Tracing the cost/benefit pathway of protected areas: A case study of the Kruger National Park, South Africa. Ecosystem Services28B: 162-172.

The Leave No Trace Center for Outdoor Ethics, United States of America. Available from <https://lnt.org/learn/seven-principles-overview> (accessed September 2018).

Tian Q, Hu J C, Liu J. 2011. Compilation of UN Conference Document on Education for Environmental Education and Sustainable Development. China Environmental Science Press, Beijing.

UNESCO. 1978. Final Report: Intergovernmental conference on environmental education, Organized by UNESCO in Cooperation with UNEP, Tbilisi, USSR, 14–26 October 1977, Paris: UNESCO ED/MD/49.

UNESCO-UNEP. 1976. The Belgrade Charter. Connect: UNESCO-UNEP Environmental Education Newsletter 1 (1): 1–2.