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# Actions for the participative rehabilitation of the National Monument Forest of Stone "Isabel Rubio"

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## Acciones participativas para la rehabilitación del monumento nacional bosque de piedra "Isabel Rubio"

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ABSTRACT

**Keywords:**
Action plan
Participation
Rehabilitation
National monument

This work was carried out in the Monumento Nacional Bosque de Piedra "Isabel Rubio" in Guane municipality, Pinar del Río province, Cuba. It was aimed at proposing the participatory actions that contribute to mitigate the process of degradation in this ecosystem. Social information was collected for this purpose. The methods used were Participatory Rapid Diagnosis, Participative Action Research, as well as the Participative Scientific Observation. The techniques used for the collection of information were: semi-structured interview and participant observation. Significant results in this study include the following. It was found that among the causes that contribute to the degradation of the ecosystem are: logging of species of high commercial value, burning of the tropical karstic forests, construction of roads and insufficient knowledge local players have in relation to the patrimonial and natural values of the monument in the area under study. The consequences of these human actions were also identified and an action plan based on four lines of work (rehabilitation, training, integration and promotion) was designed including real community participation in solving problems in relation to this heritage. It is concluded that the causes of the ecosystem deterioration are related to the anthropic action from negative positions, thus the participation of local players from a committed perspective for rehabilitation process is necessary.

RESUMEN

**Palabras clave:**
Plan de acción
Participación
Rehabilitación
Monumento nacional

El presente trabajo se realizó en el Monumento Nacional Bosque de Piedra "Isabel Rubio", municipio Guane, provincia Pinar del Río, Cuba. Tuvo como objetivo proponer acciones participativas que contribuyeran a mitigar el proceso de degradación en ese ecosistema. Para ello se recogió información social. Los métodos utilizados fueron el Diagnóstico Rápido Participativo, la Investigación Acción Participativa y la Observación Científica Participativa. Las técnicas usadas para la recogida de información fueron: la entrevista semi-estructurada y la observación participante. Como resultados importantes se encontró que entre las causas que contribuyen en la degradación del ecosistema se encuentran: tala de especies de alto valor comercial, quema del bosque kárstico tropical, construcción de caminos y un insuficiente conocimiento por parte de los actores locales colindantes acerca de los valores patrimoniales y naturales del área de estudio. También se identificaron las consecuencias de estas acciones antrópicas y se diseñó un plan de acción que se fundamenta en cuatro líneas de trabajo (rehabilitación, capacitación, integración y promoción) con la idea base de la participación real de la comunidad en la solución de los problemas presentes en este patrimonio. Así, se concluye que las causas del deterioro del ecosistema están relacionadas con la acción antrópica desde posiciones negativas, por lo que se precisa de la participación de los actores locales desde una perspectiva comprometida y participativa para su rehabilitación.

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The neglect of the environment and the mistreatment of men over their natural resources and sources have become one of the greatest problems in the contemporary world and a concern for politicians, environmentalists, ecologists, non-governmental organizations and scientific institutions around the world (Mitjans, 2012).

Mountains are among the more vulnerable or fragile, within ecosystems, to the changes that man or other natural agents can provoke according to (Rivera, 2010). In these there is a great diversity of plants, some of them registered in catalogues and studies carried out by specialists and others that perhaps are ignored by man or insufficiently studied, without ending up verifying their true importance for the humanity development.The present research is carried out in the "Isabel Rubio" Stone Forest (hereafter referred to as IRSF), which is constituted by limestone rocks, of which hundreds of mini tropical karstic forests have been chiseled that surpass 10 meters in height (CITMA, 2004). These formations, which mark the western end of the great *Sierra de los Órganos*, are considered the most picturesque in Cuba.

Nevertheless, there are critical processes at the ecosystem level that influence the stability of its flora, fauna and soil, which ultimately affect the well-being of the neighboring local players. Among these processes are: indiscriminate logging, introduction of exotic species, fires and road building caused by social indiscipline of some residents adjoining the area. There is evidence that problems such as these can be overcome through rehabilitation with the participation of local players (Mitjans *et al.,* 2013).

The above-mentioned authors affirm that this commitment requires community participation, since ecological rehabilitation requires a restoration of the spirit and a change of attitude towards what are the ecosystems, so as not to damage them and restore what has been degraded. On the other hand Rodríguez (2003) stated: *"communities must be adequately educated in the knowledge of the ecosystem and the positive or negative influence they can exert on this ..."*

Several researchers converge on this topic from the creation of participative processes to conduce the emergence of a popular critical conscience to understand the social practice as an inseparable unit of reflection and action; such is the case of the works of some authors like Rodríguez (2003), Valdés *et al*. (2008), FAO (2010), Mitjans (2012) and Marzin *et al.* (2014), which offer a current and deep focus on the community work from the participation and the social self-management, in agricultural and forest processes.

The rehabilitation, planning and administration of the natural resources require not only a physical space to be executed but also a true and effective participation of the involved local players. Thus, a development model is required to improve the relationship between man and the natural resources (Andino *et al*., 2006).

According to the FAO (2010) the forest sector in Latin America has focused more on the perception of society regarding forests, from which important changes have been experienced during the last years, with a growing emphasis on the environment, social, and cultural values. Molina *et al.* (2011) demonstrated that in protected areas, better protection and conservation results have been obtained when adjacent communities have participated. Furthermore, they have been able to explain the conflicts on degradation causes, the forests management and their relationship with the local players in studies from the resident's perception.

Therefore, it is necessary to elaborate action plans, strategies, and programs for the ecosystems forest management to educate the people involved to maximize their intellectual and spiritual capabilities from a participatory perspective, creating a commitment with the environment.

Taking into account the arguments presented above, the objective of this work is to propose participatory actions that contribute to mitigate the progressive deterioration of the existing flora in the IRSF National Monument. For this purpose the following hypothesis is formulated: if the causes that affect the degradation of the existing flora in the IRSF are known, as well as the theoretical fundamentals that support the restoration of forest ecosystems with the community participation, then it will be possible to propose participatory actions for contributing to mitigate the degradation of this ecosystem.

## MATERIALS AND METHODS

### Characterization of the study area

The study area covers 136.6 ha and is located at the western end of the Sierra de los Órganos, bordering the Cuyaguateje river and the popular councils Isabel Rubio and Molina in Guane, Pinar del Río province, Cuba.

### Vegetation and fauna

The predominant vegetation is of mesophyll semideciduous forest, with *Gerascantus gerascantoides* L., *Cedrela odorata* L., *Guarea guidonia* L. and *Guazuma ulmifolia* Lam. The fauna represents a high degree of endemism and biodiversity conditioned by its geological evolution. This has also contributed to the existence of very numerous groups such as: arachnids, reptiles, mollusks, butterflies, birds and in smaller number small mammals.

### Size and type of sampling

A total of 42 local players was interviewed from the intentional sampling: 10 direct predators, 22 adjacent to the area and 10 decision makers (officials from the State Forestry Service, Ranger Corps, CITMA Delegate, directors of the Macurije Integral Forestry Company, Community and Local Industries, the presidents of the Municipal Committee of Heritage and the People's Council of Isabel Rubio, an engineer from the Forestry Company and a sociologist from the Municipal University Headquarters also contributed in the research).

The determination of the sample size for the research was according to the procedures presented by Calero (1978) for social studies in finite populations, during the estimation of a proportion, with a confidence level (1-□) of 95%, a level of significance $(\alpha)$ of 5%, with a critical value (Z) of 1.96, a positive variability (p) of 0.95 and a negative variability (q) of 0.05, assuming a maximum permissible error (E) of 0.05.

$$n = \frac{Z^2 p\, q\, N}{N E^2 + Z^2 p\, q}$$

Where:

n = sample size.
Z = level of confidence.
p = positive variability.
q = negative variability.
N = Size of the population
E = maximum permissible error

### Methods used

The qualitative research methodology was predominantly used in this work and it was focused on the understanding of the facts, trying to identify the different perspectives that occur in the social reality from the descriptions of the social players themselves.

Qualitative research is directed throughout its development. It does not intend to enumerate or measure events, rather it is a question of interpreting what is posed by local players and generally does not use statistical instruments (Salgado and Santos, 2009).

The methods used were Rapid Participatory Diagnosis (RPD) and Participatory Action Research (PAR). In order to collect the information, the semi-structured interview and the simple and participant observation were used; exchange workshops were carried out to corroborate the results of the interview. Field trips were conducted with the neighboring players to identify the species that have been introduced into the area.

The RPD is used to know and evaluate the existing problems and opportunities in a community and at the same time to plan ideas for the solution of those problems. According to Gomes *et al.* (2001), Rapid Participatory Diagnosis (RPD) is one of the most used approaches to enable the direct participation of the population in the generation and analysis of the information collected.

During the diagnosis, participatory techniques were used, stimulating the interest of local actors in solving problems; among them the most commonly used was the Rapid Rural Appraisal (RRA), which allows field technicians to collect and analyze information on natural and human ecosystems, promote the participation of local people in forest management, and increase the capability of local people to manage their own problems, according to the criteria of Jackson and Ingles (2004). Invasive species were classified according to the criteria of Oviedo *et al.* (2012) and Regalado *et al.* (2012).

## RESULTS AND DISCUSSION

### Causes of forest deterioration

*Exploitation of marble stone.* Among the obtained results in the interview it is one of the main causes that affect the deterioration of the ecosystem, since the

marble stones are extracted by applying fire, leading to the collapse of mini tropical karstic forests and consequently the associated vegetation. The 66.6% (28/42) of respondents stated it. In this case, it coincides with Bruzón *et al.* (2008) who argued that this action is one of the human activities that most affect natural ecosystems.

*Ovens to produce marble paint.* 11 marble paint ovens were identified throughout the area, whose objective is the production of paint for trade inside and outside the municipality. Of the residents interviewed, 88% (34/42) assert that ovens favor respiratory diseases and destroy the scenic beauty of the place; those who denied this claim were coincidently detractors of this ecosystem.

*Access ways and paths***.** Roads and paths have been built by people who illegally enter the Monument for the extraction and transfer of marble stones and wood of species for commercial purposes. The main species include *Gerascantus gerascantoides, Cedrela odorata* and *Guazuma ulmifolia*. This illegal entry of offenders reaches to the extent that they are making roads to extract and transfer the stones, eliminate the present plants. Unfortunately, native species often do not recover because they can be completely extinguished. In this sense, there is a coincidence with Ramírez *et al.* (2001) who argued that the opening of roads, paths and felling of the forest to build roads not only implies a reduction of the density of trees, but drastically changes in floristic composition, including precious wood species, among others.

In the exchange workshops, 91% (20/22) of the 22 neighboring local actors assert the above, while at the same time warn that there are hardly any timber species of economic value with commercial dimensions, which shows that there is degradation of the ecosystem.
*Solid waste dumping***.** This is another problem that affects the deterioration of this ecosystem, hindering the natural development of different heliophill species that try to colonize a place, since some people from the nearest community have used it as a landfill; depositing solid residues such as plastic and sawdust, which hinders the germination of pioneering and colonizing plants, a negative issue for the conservation of forest structure patterns, what could be directly observed in the area and verified with the adjacent residents, out of which 43% of the interviewees assert that it is the place where the majority of them deposit the solid residuals. In this regard, Sierra (2006) showed that sawdust and nylon cause dissolved oxygen deficiency, hindering the development and establishment of plant and animal species.

*Insufficient knowledge of local stakeholders about the need to care for this heritage***.** The dependency ratio of this community with the site has contributed to the destruction of a large part of its resources, due to the insufficient real participation of the local players in the search for solutions to their problems; insufficient knowledge about the importance of its assets and the advantages that derive from its management; insufficient integration between institutions and community; poor management of environmental management; insufficient mastery of participatory approaches to heritage management and prejudices about the community's ability to protect its environment, are evidence of this and was corroborated through observation, exchange workshops and interviews. Out of the 42 interviewees, 64% (27/42) assert the above.

During this research the community players recognized the need to prioritize, rescue, and systematize the traditional knowledge of local players who have lived adjacent to this site, as well as carry out educational work to enrich the knowledge related to the conservation of this forest heritage. In this regard Mitjans (2012) stated *"one of the causes of greater incidence in the deterioration of forests has been the lack of knowledge of the residents on the future consequences of their deterioration, for humanity and nature".*

Another example of this ignorance is presented in the results obtained from the interviews. Of the 42 local actors interviewed, 38 (90%) did not know the heritage values that identify it as National Monument, an exceptional category assigned by the unequalled beauty and natural values.

*The introduction of exotic species.* 16 species have been introduced to the area, which coincide to be invasive (Table 1). The 62% (26/42) of the respondents identified these species, also raised that in the last two decades, there has been a significant increase in the volume of evidence on the harmful effect of biological invasions and

also on the global interest of the scientific community for this problem.

**Effects produced by anthropogenic actions**

In recent years the harmful effects of man on forest ecosystems as well as the inclusion of invasive plant species have been widely recognized. Local, regional, national and global programs have been developed to curb their proliferation and mitigate their present and future impacts (Vilamajó *et al.*, 2002).

**Table 1.** List of invasive species identified in the IRFS.

| No. | Scientific name | Family | Origin |
|---|---|---|---|
| 1 | *Caesalpinia violacea* (Mill.) Standl. | Caesalpiniaceae | Mexico |
| 2 | *Cocos nucifera* L | Arecaceae | Africa |
| 3 | *Cordia obliqua* Willd. | Boraginaceae | India |
| 4 | *Delonix regia* (Bojer ex Hook.) Raf | Caesalpiniaceae | Madagascar |
| 5 | *Dichrostachy scinerea* L. | Mimosaceae | Africa |
| 6 | *Eucaliptus citriodora* | Myrtaceaea | Australia |
| 7 | *Ficuscras sinervia* Willd. | Moraceae | Unknown |
| 8 | *Hura crepitan* L. | Euphorbiaceae | Tropical America |
| 9 | *Leucaena leucocephala* (Lam.) de Wit. | Mimosaceae | Tropical America |
| 10 | *Melia azedarach* L. | Meliaceae | Pakistan |
| 11 | *Melicoccus bijugatus Jacq.* | Sapindaceae | America |
| 12 | *Mimosa pigra* L. | Mimosaceae | Pantropical |
| 13 | *Samanea saman* (Jacq.) Merill. | Mimosaceae | South America |
| 14 | *Sterculia apetala* (Jacq.) H. Karst. | Ustercliaceae | Tropical America |
| 15 | *Terminalia catappa* L. | Combretaceae | Asia |
| 16 | *Albizia lebbeck* (L.) Benth. | Mimosaceae | Asia |

Coinciding with Álvarez (2005), the effects caused by anthropic pressure, if not controlled, can lead to the loss of biodiversity, among the most relevant found effects are: destruction of wildlife habitats, landscape modification, deforestation, environmental contamination and burning of marble, introduction of exotic and invasive species, this could be verified in the area through tours with the players involved.

These effects have conditioned the continuous loss of the constituent elements of the natural ecosystem, in terms of their structure and composition, due to the anthropic disturbances which can affect the loss of biodiversity. In this sense, there is a coincidence with Álvarez (2005) who argued that degraded or disturbed forests are those that have modified their structure, operation and capacity to provide services and products. Rosete *et al.* (2011) stated that invasive plants such as *Dicrostachys cinerea* have devastating effects on the structure, balance, dynamics and health of the forests. This specie was observed during the tour in several places in the study area.

**Plan of action for the participative rehabilitation of the National Monument Forest of Stone "Isabel Rubio"**

*Actions to encourage the rehabilitation of the forest*

- Select possible seed stands for nurseries to plant production.
- Establish the perimeter fence to limit the entry of detractors to the area.
- Establish a micro nursery in the adjacent community to the IRSF.
- Reforesting by using native species seedlings produced in the nursery.
- Perform by enrichment works with native species throughout the area.

- Perform an inventory of the existing flora.
- Develop a management plan that guarantees the protection and conservation of the IRSF.

*Actions to upgrade the local actors adjoining the Monument*

- Provide upgrading courses on the importance and care of the IRSF assets.
- Provide an environmental education course on waste pollution issues.
- Video debate about tropical karstic forests formations and National Monuments.
- Conduct exchange workshops to socialize the experiences of community leaders who are better trained in the subject.
- Make a catalogue that provides information about the heritage values of the Stone Forest.

*Actions to achieve the integration of the neighboring actors*

- Conduct conversations with representatives of the institutions and organizations involved, in order to reflect and assess the need for coherent articulation and integration for the rehabilitation of the IRSF.
- Propose tasks where it is possible, to carry out integration actions (participatory rehabilitation, voluntary works for the collection of residuals).
- Involve all local players and decision-makers in the decision-making of the tasks.

*Actions to promote the natural values of the IRSF*

- Elaborate and distribute brochures with topics related to the IRSF.
- Disseminate information by the local radio, on the tasks that are done for the rehabilitation of the National Monument.
- Make signs and posters with various advertisements on the conservation of the IRSF.
- Launch competitions with various topics on the natural resources of the IRSF, in schools of different teachings.
- Make a logo that identifies the place, to promote the project and the National Monument.

## CONCLUSIONS

The ecosystem deterioration causes are related to the negative positions from anthropogenic actions, so a rehabilitation process is necessary from a committed participatory perspective by the local players.

The proposed action plan is focused on the people, their experiences and knowledge; it is projected to get the goals from their joint achievements, as well as on an active and conscious participation in the elaboration and execution of activities to favor the socio-environmental transformation by the community.

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