제주도 화산동굴 서식 고유종 보존방안 (Conservation Measures for Endemic Species in Jeju Volcanic Caves)

제출자	**팀명***	*Greenfingers JeJu*
	팀원	**김수연**
		장휘림

마이더스의 손처럼, 저희의 손 닿는 모든 곳의 자연이 더욱 푸르러지길 바랍니다.

Background Jeju Island's volcanic caves are the only habitats for seven endemic cave-dwelling species. They are vulnerable to changes in the cave environment. Meanwhile, the representative endemic organism Nesticella quelpartensis is currently assessed NT category of the IUCN Red List and is potentially in a severe extinction risk. Today, the international and the scientific communities emphasize the need for support to prevent extinctions, especially for small-scale geographic endemic species. As Jeju received recognition from UNESCO for its efforts to conserve biodiversity, it is urgent that Jeju make effort to conserve the internationally remarkable biodiversity of Jeju caves.

First Policy Proposal Firstly, the current lighting system brought extreme disturbance to cave ecosystems such as green and light pollution, drying, temperature increase, and invasion of foreign species. Secondly, tourist visits cause the inflow of CO2 and airborne particles, modifying the normal average annual temperature, humidity, and atmospheric circulation system of the caves. However, the tour caves on Jeju show passive attitudes to such issues and do not publicly share their efforts of cave conservation. **Proposed Actions are followings:**

(1) Re-evaluate Lighting System and Relevant Municipal Ordinances

- For caves with significant algal blooms, such as Hyeopjae, Ssangyong, and Micheon Cave, shorten the lighting rotation cycle.
- Equip minimum lights that guide visitors to fulfill Article 5, Paragraph 15.
- Attach motion sensors to turn off lights when no visitors are present inside the caves and shielding covers to minimize light scattering, complying with Article 1, Paragraph 5, Section 1 of Chapter 2 and Article 15, Paragraphs 1 and 4.
- Remove the colored lights in Manjang and Micheon Cave to fulfill Article 15, Paragraph 2. Modify the ordinance from "discouraged" to

"prohibited" for colored lights in Jeju City, as they do not serve practical safety functions.

- Modernize lighting system by noting the precedential cases that enhance the appeal of caves by considering that the "darkness" is attractive.

- Convert the current open-door tour program to guided tours led by interpreters, complying with Article 5, Section 2 of Chapter 1. Delete the phrase "unavoidable circumstances" from the ordinance in Jeju City to prevent its misuse.

(2) Prevent Environmental Disruption and Revise Relevant Municipal Ordinances

- Hallym Park and Ilchul Land do not conduct real-time monitoring of tourist numbers as they are not pushed to do so by the government. Thus, we suggest an automatic monitoring system called People Counting System. It records visitor traffic, fluctuations, and hourly counts entering the cave.

- Minimize the entry of pollutive matter by installing air curtains and shoe disinfection mats at the entrance of the cave.

- Establish equipment capable of immediate monitoring of temperature, humidity, CO2, radon, etc., and develop protocols for immediate responses to anomalies.

- By mandatorily deploying management personnel so that caves can respond to monitoring outcomes or unexpected tourist behaviors.

- Shorten the period of governmental cave envrionment inspection, improve the standard for it, and disclose its results to the public to fulfil the Article 7.

Expected Outcomes This will contribute to the conservation of unique cavedwelling species and cave ecosystems in Jeju Island as well as generating additional values such as tourism revenue.

Second Policy Proposal About 37% of Jeju caves are collapsing due to

road construction, accelerating the invasion of external organisms, but most of the caves are not being managed. Since well-preserved caves have significant potential profitability with minimal investment or moderate number of tourists, the continued collapse of Jeju caves may result in big losses for Jeju's tourism industry. Proposed Actions are followings:

(1) Strengthening Regulations

- Develop environmental impact assessments and preliminary feasibility criteria suitable for Jeju's unique geological characteristics.
- Enhance standards both for the equipment and evaluators used in evaluations.
- Establish a democratic surveillance system by appointing environmental organizations and volcanic cave experts for preemptive ground surveys.
- Provide national-level support for collapsing caves.
- Develop specialized response protocols for the collapse phase.
- Conduct comprehensive surveys on caves, including those excluded from designation as cultural heritages, categorizing them by collapse risk.

(2) Enhancing Supervision of Private Corporations

- Impose periodic monitoring obligations on private corporations responsible for environmental impacts even after construction completion, with regular audits by government bodies or local authorities.
- Disclose the information so that survey results may easily accessed by locals. Expected Outcomes By adapting these guidelines, inappropriate construction of roads will be prevented. Clarifying road constructors' responsibilities for future management and supervision will ensure the preservation of cave ecological and economic values and local safety.

Third Policy Proposal Despite its attractiveness, no promotion or education material mentions the Jeju cave endemic species. This is a problem because firstly, it unables showcasing the caves' identity or unique values to tourists. Secondly, the current exhibition methods fail to motivate the private owners of the caves to prioritize environmental conservation since no direct correlation between environment conservation and profit is shown. Lastly, visitors cannot get an opportunity to develop their interests in Jeju's unique cave ecology, leading to a low-level public awareness about the necessity of conserving the endemic species. This leads to vicious cycle by reinforcing the passive attitude of management. Meanwhile, Daegeum Cave demonstrated that advanced cave tourism generates approximately 1.9 billion KRW of profit with less than the half of another cave's visitors. **Proposals are as following:**

(1) Development of Experiencing Tourism Programs

- Develop storytelling tour program based on the ecological, historical, and cultural uniqueness of Jeju caves.
- Adapt guided tour programs led by cave interpreters with limited-size groups.
- Develop educational tour, highlighting the importance and threats that caves are facing and including direct observation of endemic species' habitats.
- Offer indirect experience programs using digital technologies as Augmented Reality and Virtual Reality, referring to the Yeongwol Cave Ecological Center and the digital insect-themed park in Yecheon, Gyeongsangbuk-do.
- Place at least one administrator in visitor center to conduct pre-tour education about the cave's features and highlights and to control the number of tourists.

(2) Promotion and Education

- Add information about the value of the Jeju cave ecosystem into Jeju Special SelfGoverning Province's environmental education plan.
- Promote the existence of unique cave-dwelling species to the public, utilizing developed storytelling for the cave tourism.
- Utilize souvenir shops and visual media to promote caves' distinctiveness, featuring Jeju cave endemic species and encouraging visitors' attention to them.

Conclusion To conserve the endemic species living in Jeju volcanic caves, we propose a policy in three aspects: cave tourism, collapse, and education.