

This project was carried out by the Technology of Natural Sustainable Ecosystems research group and granted by SGP (Small Grant Projects of Global Environment Facilities), co-financed by Forests and Rangelands Organization of Ilam and the Technology of Natural Sustainable Ecosystems Research Groups (TONSERG).

The study sites are located on the Zagros region in Ilam province of Iran. Ilam Province is located at the west of Iran, bordering Iraq in the west with 425 kilometers of common border. Iran is located in the Middle East and lies between latitudes 24° and 40° N, and longitudes 44° and 64° E. The Zagros Region runs from northwest to southeast of Iran, covering 11 provinces of Iran. The Zagros Mountains contain several ecosystems of which the most prominent one is the Oak forest. Zagros forests are the natural forests of Iran which have gradually been undergone their inner capability of survival due to the inappropriate management as well as climate changes. This resulted in the drought of the vast part of the forest, especially Oak trees. Oak tree species as the first over story of these forests and their leaf type are the first sacrificing species in the Zagros forests of Iran. Even though the reasons are quite diverse even in similar species. Ecological shelters, climate change, various genetic patterns of the Oak stands and different sensitivity to the environmental stresses such as contaminants of dust storms and nutrition shortage are regarded as some of the possible causes of this issue. Due to the above mentioned situation and highly disturbed area, Ilam province was selected as the case study.

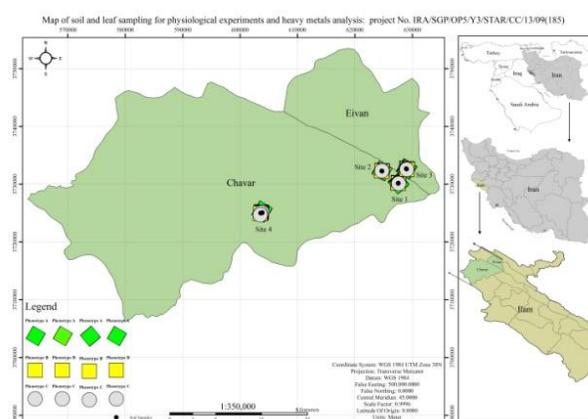
The selected studied areas are located surrounding 2 villages: Golah Jar and Golzar. The number of families of these villages is 75 and the population is 291 people including 138 men and 153 women. In this region, people have accessibility to the good quality water. As the other basic constructions, these villages have primary school, urban gas feeding systems and so on. Most of the families have their own farmlands (most of them own about 3 to 5 ha of the land) on which usually barley and wheat is cultivated. More than half of the families keep livestock and approximately 70% of them are literate. The biggest problem in these villages is the negative population rate of these villages and most of the people belong to the 30-50 years old age classes which indicate that the population will grow old in the next decades.

The main goals of this project briefly are:

- The assessment of forest ecosystems of Ilam and the fundamental study on the selected sites
- An evaluation on eco physiological and climatic reasons of die-back of Oak trees in the four selected sites
- Identification and introduction the genetic diversity of Oak forests of Ilam province as a basis for the rehabilitation management
- Determination of stable and elite intra-species in order to apply for rehabilitation management
- Provision of certified seedlings from the collected seeds to be applied for rehabilitation management

- Introduction and promotion using the biological fertilizer in each ecosystems to be applied for rehabilitation management
- Identification of plant, economic, social potential of the selected sites to presenting an appropriate approach to lifestyle promotion
- Rehabilitation management of a 2 ha pilot ecosystem
- Discovering the crisis and presenting the solutions

To reach the above-mentioned goals, after inspecting the whole Oak forests of Ilam province, four sites were chosen in different districts to provide a comprehensive assessment of sensitivity of Oak trees to the heavy metals of dust storms as well as shortage of nutrition. The first site was the only study site which was located in a 22-year highly conserved area and with a high disease rate, the second site was located in a moderate percentage of disease, but under cultivation and the third one was located in an area with the minimum number of damaged trees and under cultivation. The fourth site was chosen in Anaarak region located near the border with Iraq, where the physiological damage to the trees was relatively high. The previously mentioned sites are demonstrated in the Figure 1. We considered the three different phenotypes in each study sites: almost and completely healthy trees with less than 20 percent damage (A), Semi-healthy stands with between 20 to 80 percent damage (B) and completely damaged stands with more than 80 percent of damages (C). The sampling was done and 5 replications of each phenotype were selected in each studied sites (in total 60 individual trees). Two soil profiles were dug up to the 80 cm depth from the soil surface in each study site. All samples were collected in order to assess the amount of heavy metals and the most important nutrition content as well as soil microbiology experiment.



Zn, Ni, Pb and Cd was measured in all samples and results ranked from the highest to lowest amount of heavy metal contaminants of the studied ecosystems. The maximum amount of contamination among the 4 studied sites was measured in the leaves and soil samples of site 4 (Anaarak region), the region which is the closest studied area to the border of Iraq. These results comply with the results obtained from the engineering office of the Forests, Rangelands and Watershed Organization of Iran. The most polluted area with the heavy metals exactly located in the area with 75-100% damages based on the map of zoning the Die-back of Oak trees of Ilam province. Therefore, we cannot ignore the role of dusts which are mostly carrying heavy metals such as Pb or Cd.

The dust storms due to the blow of dominant winds from the western neighboring countries such as Iraq, the domestic dusts, the consequences of the gas refinery located near the studied area, resulted in the damages to these Oak stands which also in turn is a menace to the health of the local people living in the ecosystem, since appropriate filters for the purification of the smog is not applied. Besides, pests and bacteria are considered as the second important the threatening factors affecting the ecosystem.

However, the amount of the heavy metals is measured very high even in the depth of 50-80 cm of the soil profiles. Meanwhile, the amount of contamination did not change in this depth compared to the lower depth of soil due to the weakness of the microorganism. However, this is important that neither leaves nor soil showed the shortage of nutrition in this project. The microorganism activities were reduced, but their measured value didn't ruin the chance for rehabilitation management. **Hence, there would always be a possibility to rehabilitate natural forests as long as the forest soils show about 40% of their natural potential.**

On the other hand, the results revealed that the phenotypically healthy stands (Group A) were highly capable of phytoremediating the contaminants and surpass the other stresses. To assess the genetic diversity of oak species in Ilam province, 70 individual Oak stands (which were scattered through 4 different districts) were selected. The results demonstrated a very remarkable genetic diversity in the Oak forests of Ilam province. The phenotypically healthy stands are placed in the different genetic classes form the other stands. **As a result, the hypothesis of the genetic extinction of oak forests of Zagros region is totally rejected by the finding of this project.** As a whole, the health of these individual trees is due to the intra-specific species properties such as leaf stomata or other physiological traits and it is very probable that these individual trees are indicators of a valuable specific genetic pattern.

The main outcomes of the project:

- Introduction the elite and stable intra-species and inter- species in the current situation
- Approval of the fact that the phenotypically healthy stands are placed in different genetic groups compared with the other studied stands
- Rejection of the hypothesis of genetic extinction of Oak forests of Zagros based on the finding of this project
- The rehabilitation management in 2 ha area applying new methods such as biological fertilizer despite the severe destruction of forest ecosystems of Ilam as well as the dust storms role and Die- back of Oak forests in this region
- Introduction of plant, social and economic potentials of the ecosystem and providing the proper plan for the economy and lifestyle promotion of the local people of the selected region
- Publishing papers and making documentary films from this project

The results showed that the dusts not only negatively affect the transpiration and photosynthesis of the plants in the over story, but also they contaminate the environment, especially the rooting systems and soil, since they bear heavy metals in their molecular construction. However, there would be the chance to

rehabilitate these areas especially those located in the border of Iraq with the elite and fast growing Oak stands or the other endemic species in three different rows instead of planting exotic species such as *Prosopis juliflora*. Since, the stable stands showed very stability in all these tensions and still are able to uptake the contaminants. These findings proved that if the environmental conditions continue this way and no genuine management of the dust control in this area is applied, the complete loss of the forests in this area will be inevitable. Therefore we will face many catastrophes such as heavy rains and flood (as it occurring often in this region).

Finally, the goal for the next phase of study is to improve the lifestyle of local people concerning the forest ecosystem potential of the area thanks to community participation in the rehabilitation programs of the forest ecosystem. This, in turn, will result in the empowerment of the local people by threatening them about the possible mortality reasons of forests and its catastrophic consequences as well as using the results of the first phase -identification of alternative lifestyle regarding the available ecosystem potential such as by-products of forests and rangelands and ecotourism-. Finally, based on the identified and presented main and subsidiary sources of revenue of the local people in the first phase of the study, the production and selling methods would be facilitated.

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Colleague of the high council of forest, rangeland and watershed organization of Iran, executive member for holding workshops in this organization	Gorji Imani	Executive member of the data processing and translator	Seyedmahmoud Monemian
Executive colleague for running genetic experiments	Hasan Soltanlou	Executive member of the GIS maps	Seyed Ali Naghibi Rad
Executive colleague for microbiological experiments	Maryam teymouri	Director of the documentaries of the project	Sadegh Dehghan
Executive colleague of field samplings	Babak Jalilpour	Member of the council of Golzar village	Rahim Feizollahi

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