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The Root Results of Oak Sudden Death in Plain Barm, Zagros Forest, Fars, Iran

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Abstract

Quercus is a dominant genus throughout Zagros mountain forest and has been for the past 5,000 years or more. Oak distribution has shifted in response to changes in climate, disturbance regime, and human population and culture. Oak dominance has decreased throughout the 10 years of since 1998. In the recent decades the Mediterranean and semi-Mediterranean forests have been faced with climate changes. Zagros forest is 5milion ha of Iran forest that located in west of Iran. Most of species is oak involve Persian oak (*Quercus. Brantii Lindl*). During of 1998-2014 several reported of sudden oak dead with charcoal disease (fungi disease). The disease was spread of all Territory of Zagros Mountain that caused to dead of 1miliom hectare of oak. In the Zagros Mountains we would attitude 'integration' through a strong focus on local participation. Aims to conserve the biodiversity by using participatory approaches that ensure the active involvement of local people. Iran loss 1.5milion ha of its forests through spread of disease and pest in Zagros Forest. These include the charcoal disease and *Chrysobothris Parvipunctata* beetle of Buprestidae family that become aggressive on stressed trees, and several root and stem decay fungi. In its study we were surveyed the root results of oak sudden death in plain Barm, Zagros forest, Fars, Iran.

Keywords: Oak Sudden Death; Charcoal Disease; Beetle of Buprestidae; Zagros Forest; Fars; Iran

Introduction

Iran is positioned on the southwest of Asia forming a bridge connecting three continents of Asia, Europe, and Africa. It is bordered by Azerbaijan, Armenia, Turkmenistan, and the Caspian Sea on the north, Afghanistan and Pakistan on the east, Oman Sea and Persian Gulf on the south, and Turkey and Iraq on the west (Road Atlas of Iran 2004). The country is part of the Iranian Plateau that constitutes a vast and high terrane, which is bordered by the Caspian Sea on the north, Amu Darya, Syr Darya, and Kora River plains on the northeast, Sindh and Punjab Rivers plain on the southeast, the Oman Sea and the Persian Gulf on the south, and the Tigris river plain on the southwest. The total areal extent of the plateau is about 2,600,000 km^2, of which 1,648,195 km^2 is accounted for by Iran, and the rest covers Afghanistan, Pakistan, and former Soviet republics. The area of Iran is 3.7% of Asia and 1.09% of the total land on the Earth's surface [1].

The Iranian Plateau is a triangular-shaped piece of land between the Persian Gulf and the Oman Sea on the south and the Caspian Sea on the north and plays the role of a bridge between Central Asia and other plateaus in western Asia and Europe [2]. The longest stretch of Iran runs from the Ararat Mountains northwest to the Goater Port on southwest and measures 2,210km, while the widest stretch is between Sarakhs on the northeast and the Arvand River on the southwest, measuring about 1,400km [1]. Half of Iran's land surface is mountainous, 1/4 covered by fertile and productive plains and the other 1/4 covered with salty arid deserts [2].

The southernmost point of Iran is the Goater Port located on 25° N latitude, and the northernmost point is the Ararat foothills 40°N. The easternmost point is Kuhak on the border with Pakistan, while the westernmost point is Bazargan on the border with Turkey. Iran's geographic coordinates are between 44° and 63° 5¢ 30″ E longitude and 25–40° N latitude [1].

The time difference between the easternmost and westernmost points is about 1h and 18min. The perimeter of Iran is about 8,700km of which 2,700km (or nearly one-third) is marine (Persian Gulf, Oman or Makran Sea and Caspian Sea) and the rest is terrestrial. The marine border line from the Arvand River estuary to the Goater Port stretches about 2,000km [1]. Based on the latest administrative division system provided by the Interior Ministry of Iran Website, Iran consists of 31 provinces, 385 counties, 961 districts, 1,120 cities, and 2,473 rural districts (Figure 1).

Figure 1: Administrative division map of Iran.

Zagros Mountains

These mountains begin in Kordestan and extend to Khouzestan, Fars, and the southern coast. The length of this mountain range is about 1,000km and its width around 200km. These mountains are much more expanded, well ordered, and simpler (from stratigraphically standpoint) than Alborz. Most geographers call Zagros as "Great Jura" because there are well-ordered and compressed anticlines and synclines than those seen in Alborz and look like what is seen in the Jura Mountains of Europe [1].

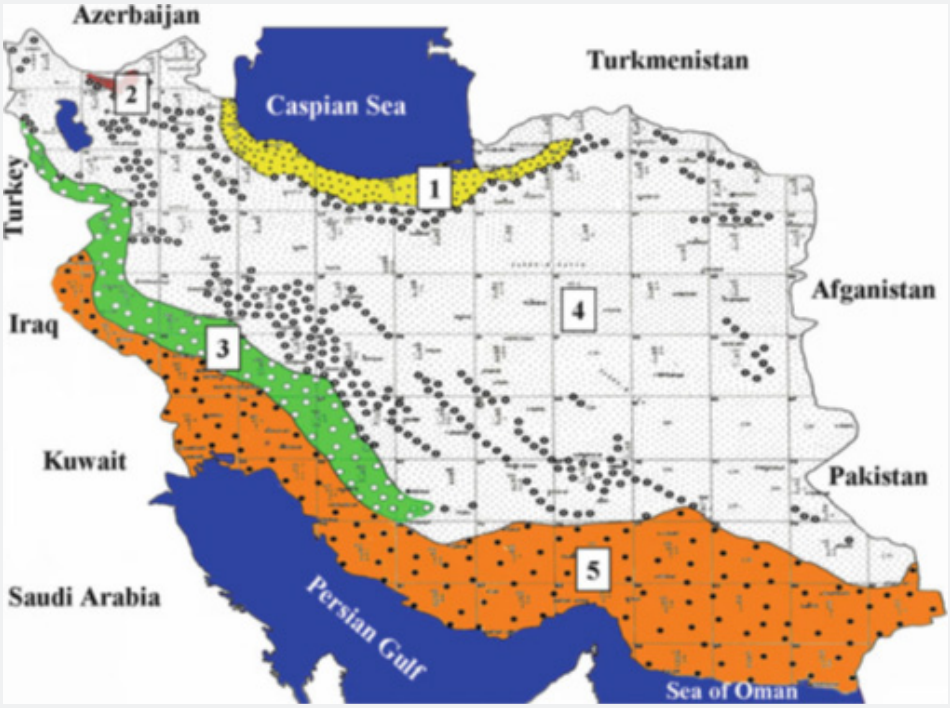

Figure 2: Phytogeographical regions of Iran (Euxino-Hyrcanian: 1 Caspian (Hyrcanian), 2 Arasbaran; Irano-Turanian: 3 Zagros, 4 Steppic central plateau, 5 Saharo-Sindian).

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Western and Southwestern Mountain Ranges

The highest mountains in Lorestan are Oshtoran-kuh (4,050 m) and Garin (3,645 m). In middle Zagros, the highest peak is Dena (5,200m), which is the highest in all Zagros Mountain range. In northern Zagros (Kordestan and Kermanshahan), the highest mountains are Chehel-cheshmeh (3,173m), Shahou (3,390m), and Parou (3,357m). The Alvand Peak in Hamedan Province with a height of 3,580m is one of most beautiful mountains in Iran.

The Zagros Mountain blocks the moisture coming from the Mediterranean and Atlantic Ocean on their western flanks, resulting in the formation of huge reserves of snow and ice. The water produced due to melting of these reserves runs down through numerous valleys, such as Karoon, Karkheh, and Zayandeh-rud. The rivers originating from Zagros erode the mountains, especially in the northern and central parts. In some places, rivers like Zab and Sirvan cut the mountains sharply, while in the southern part, due to orderly folding of Zagros, rivers carve their valley parallel to the axis of the mountains (Orohydrography Map of Iran 1994) (Figure 2).

Oak Forests in Iran

Zagros forests, in the west, cover about 5 million hectares, comprising the semiarid forests important for protecting water supplies, regulating climate, and providing nonwood forest products. Tree Species in Zagros forest are mostly oak that involve: *Q. persica*،*Q.infectoria*، *Q.libani*، *Q.magnosqumata*. Other species mostly involve: *celtis caucasica, Amygdalus scoparia, A.lycioides, Daphne mucronata, Pistacia atlantica*. Zagros forest mostly sever numerous other environmental, social and rare economical functions. They are vitally important for preserving watershed for adequate water supply in Zagros mountain, Zagros forest provide shelter for wildlife, recreation and aesthetic renewal for people, Zagros forest is providing fodder for grazing of animal husbandry that is tools of livelihood of local people involve tribes and villages. Oak is very important in Zagros mountain Due to benefits of *Quercus brantii*. and its important role in soil and water protection.

Oak Decline

Oak forests in the Zagros Mountain are affected by declines. Characteristics of the site including both poorly and are predisposing factors. Inciting factors that have been important in the past include drought, fungi, dust, and defoliating insects and diseases. Many contributing factors have been associated with oak decline. These include the charcoal disease and *Chrysobothris Parvipunctata* of Buprestidae family that become aggressive on stressed trees, and several root and stem decay fungi.

Sudden Oak Death

The symptoms that define Sudden Oak Death were first recognized in 1998-2014. Over the next few years, SOD reached epidemic proportions in oak forests along approximately 1milion ha of the central Zagros coast. The main hosts included fungi disease in Persian oak. The rooting result of oak death was Outbreak of charcoal disease caused of fungi of B. Mediterranean on Quercus SPP Trees in forest of Zagros Mountains in Iran. Ascospores of Biscogniauxia mediterranea on Quercus brantii was find in 2010 in Zagros forest (Figures 3 & 4).

Figure 3: The symptoms of charcoal disease on *Quercus brantii* as brown-black discoloration of woody tissues (A), strip bark peeling and on stem (B) and the bark scaling (C) and symptoms on *Quercus castaneifolia* and *Zelkowa carpinifolia* (D, E).

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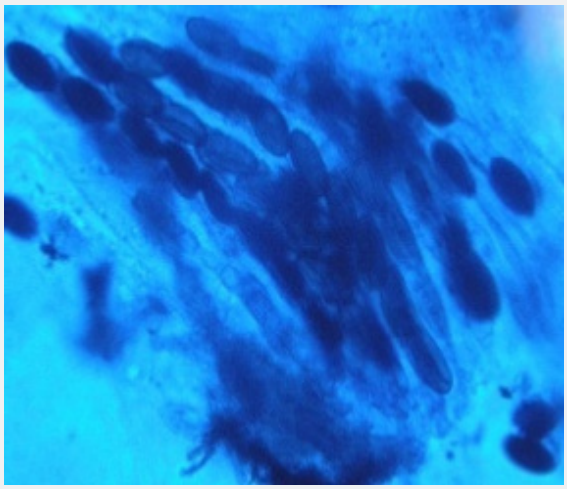

Figure 4: Ascospores of *Biscogniauxia mediterranea* on *Quercus brantii* Mirabolfathy et al. (2011).

Recent oak decline, which covers a relatively vast area of Fars province, the oak forests of Plain-Barm which were most exposed to drying. Infected factors on dead oak including human factors (branch and/or clear Cutting and pruning, rain-fed farming under the trees in the forest floor, etc.), climatic factors (rainfall and temperature), and disturbing factors (pests and diseases) were assessed. Oak forest which dominates between 1,000 and 2,000 m elevation of Zagros Mountain that almost 40 % of the country's forests.

Losses or dramatic declines of forest species, populations, or age classes due to pests and pathogens can have major impacts on ecosystems. These impacts include changes in ecosystem structure, decreased biodiversity, changes in hydrology and nutrient cycling, and cascading impacts throughout the food web [3,4]. The potential for forest pests and pathogens to interact with other ecological perturbations and yield unexpected or nonlinear responses is of concern [5,6].

Insect

The knowledge of the interaction between insects and oaks in Zagros forest is still very poor. Although often unnoticed, ignored, or unappreciated, insects can be the most numerous, diverse, and damaging animals inhabiting forests. Insect damage to forest trees results directly from ingestion or destruction of plant parts that are fed upon, from colonization (such as tunneling or boring) of trees during feeding and reproduction, or from toxins they egest. The degree of damage that results from these activities vary widely among insect species, their various immature and mature stages, and the tree species and its stage of development from seedling to mature tree. The size of the insect population often strongly influences the degree of damage that results. Because the part of the tree that is damaged also influences whether the damage is merely cosmetic or serious, the different locations of feeding and breeding on and in trees is a convenient way to categorize groups of insects that damage forest trees.

Chrysobothris parvipunctata beetles (Figures 5 & 6) infest their galleries with fungi that serve as food for their larvae. Bark beetle adults bore through the bark and produce tunnels called "galleries" in the relatively thin area composed of the vascular cambium and adjacent phloem and xylem. After mating, females lay their eggs between the bark and the wood, either along their galleries or in special niches.

Figure 5: Adult stage of the Cerambicedea beetle, *Chrysobothris Parvipunctata*. These individuals have recently emerged from their pupal cases and will soon disperse to infest other trees (Photograph by author).

Figure 6: Larval and Galleries excavated by larvae of the smaller *Chrysobothris Parvipunctata* beetle. Not only does this beetle inflict damage by its feeding activities, but it is also a vector of the Oak disease fungus (Photograph by author).

Two species of insects of *Buprestidae* family that have spreading in the Zagros forest through decrease of rain involve: *Agrilus biguttatus*, Fabricius (1776) and *Anthaxia hungarica*, Scopoli (1772). Other Disease Insect in Zagros Oak Forest Involve: *Leucoma wiltshire, Tortrix viridana, Porthesia melania(Strand), Laspeyresia fagiglandana(Zeller), Marsham Curculio glandium, lymanteria dispar(Linnaeus), Malacosoma nustralia, Tortrix viridana (Lep.: Tortricidae)* and *Cynipidae. Tortrix viridana* is a serious pest of oaks in the Fars oak forests. Oak bud tortricid (*Tortrix viridana*) has five larval instars in Fars oak forests. The pest overwinters as diaposed eggs. The first larval instar emergence coincides with tree budburst when they enter bud scales. *Porthesia melania Stgr*. (Lep., Lymantriidae) is the most important pest of oak trees in Zagros Forest, either and its larvae feed on upper surface of oak leaves. The highest

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and lowest densities of larvae were observed in the late March and mid-May, respectively. During summer and winter, no larvae were observed on oak leaves. The third larval stage which lasted eight months from the late July until mid-March in diapauses form, was the longest life stage of the oak moth. The pupae were formed in the soil.

Forest Pest Management Principles and Practices

Knowledge of the biology of tree and insect or pathogen interactions may suggest one or more appropriate pest management principles. These principles can be considered "strategies," or general approaches to minimizing the effects of damaging agents on trees and forests. Six strategies that are employed in forest pest management, including attempts to control pests of nursery seedlings and landscape trees, are:

i. **Resistance:** Utilization of trees with inherent, genetically controlled characteristics that minimize pest impacts, or use of practices to increase the ability of trees to defend themselves;

ii. **Exclusion:** Prevention of the introduction of a pathogen or insect to an area where it is not already present;

iii. **Protection:** Placement of a barrier or other material (usually chemical) that interferes with interaction of the pest and the tree;

iv. **Eradication:** Removal or destruction of pathogen or insect life stages to reduce or eliminate pest populations;

v. **Avoidance:** Utilization of locations, conditions, or practices that do not favor, or even suppress, development of disease and/or insect infestations;

vi. **Therapy:** Treatment to cure already diseased or infested trees (may involve employment of one or more of the other strategies listed above).

Clearcutting, Regeneration and Burning

Clearcutting and burning results in the immediate loss of pest and fungi, and selective logging will modify forest structure and microclimate. After secondary forest regeneration in clear cut areas or on plantations (and agroforest ecosystems), at least part of the species may reestablish. The resulting distribution patterns of fungi and their communities are diverse, reflecting the microclimatic and substrate conditions in their secondary microhabitat, and the progress and speed of succession. This involves cutting in three phases:

In the first phase, the patient trees, or those with unwanted characteristics, are removed to create space for more highly preferred trees, thereby also halting the development of undesirable specimens or entire species. In the second phase, favourable conditions allowing oak regeneration (basically controlling canopy opening) are promoted. In the third phase, the remaining mature trees are harvested, once the new crop has been established, thus removed tree would burning that pest was not spread in all country.

Figure 7: Budding of cleared oak trees in Plain-Barm (Photograph by author).

Figure 8: Budding of cleared oak trees in Plain-Barm (Photograph by author).

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Felling of Diseases Trees

Diseases trees were clear in autumn seasonal by saw. In spring some of its tree have regenerated (Figures 7 & 8).

Pruning

Dead branch of oak tree in pilot forest of Plain-Barm, Kazerun in 30ha was cut by saw. In spring seasonal (after 3 month), the trees blossomed (Figure 9).

Figure 9: (a) Before and (b) 4mounth years after moderately heavy pruning in an old 0ak tree, about 70% of the stand basal area was removed. (Oak tree before and after cutting in Plain-Barm) (Photograph by author).

Burning

Thus, gather to cleared wood, burning pest tree to fungi was final phase in treatment and improvement of polluted forest (Figure 10). The evaluation of oak decline in Missouri (America) showed that oak decline was as a result of interacting factors of tree stress (insects, drought, and freezing) secondary diseases and pests (root fungi and insect holes). Subsequently, the tensions cause to weaken trees, reduce growth, and eventually lead to die [7]. Trees faced to long-term stress (pollution and competition) are susceptible to die in the short-term effects of environmental stresses (drought, insects and diseases) [8].

Figure 10: Burning pest tree (Photograph by author)

The study conducted in the Netherlands showed oak decline is associated with fluctuations in groundwater [9]. Ogaya [10] in Spain concluded that drought phenomena caused to decrease biomass and tree growth and eventually led to tree growth. The research was conducted in the South-East Sweden indicated that reduction the size of the trees, Sunny habitants, non-clay soils and pests are the obvious features of habitants with decline trees [11].There are many factors that cause to make decline so that various studies in different areas prove this value. Adverse condition of climate makes vulnerable habitants for investing pests [12] and growing fungi [13], increasing air pollution and decreasing soil nutrients [14,15]. Increasing the temperature had a significant effect on tree growth in south of Europe [16].

Drought can have in fact a strong impact on carbon fluxes and thus on the carbon sequestration potential of ecosystems. Experimental drought and warming resulted in a trend to reduce 33% the biomass of a Mediterranean shrubland [17]. Stem diameter increment of *Quercus ilex and Arbutus unedo*, two typical Mediterranean species, were reduced by 41 and 63%, respectively, in an experimental 5-year drought treatment, as well as the increment of live aboveground biomass (by 83%), together with increased mortality rates [18]. *Quercus ilex* showed strongly decreased net photosynthesis rates (44%) and stomatal conductance (53%) in autumn after a drought treatment [10].

During the last four years (2009- 2012) several reports of forest tree decline were received, complaining about serious damage and death of many trees. The disease has been spread throughout forests of Zagross mountains which extend from north west to south west of Iran covering approximately 4,000,000 ha. Also, the disease has been spread throughout forests of Alborz mountains in the north of Iran. The infected tree species included *Q. brantii, Q. castaneifolia* and *Zelkova carpinifolia. Q. brantii Lindl.* (Persian oak) has dominated in all parts of Zagros mountains from north to south, especially on the southern side of mountain in Ilam, Lorestan, Kohgilouyeh va Boyer-Ahmad, Fars and Kermanshah provinces. Zelkova

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carpinifolia (Pall.) Dippel, and *Quercus castaneifolia* C.A. Mey are native to the Caucasus and Alborz mountains in northern parts of Iran. The decline began with browning of the leaves, viscous liquid exudation on the branches and trunks resulting in a brown-black discoloration of bark and woody tissues. In the winter of the next year fungal growth induces a typical charcoal-black surface on diseased branches and trunks. The perithecia of *B. mediterranea* were observed in a black carbonaceous layer on the stem surface erupting from the declined trees and the ascospores were visible under light microscope. Perithecia were obovoid, containing, amyloid asci, with dark brown ellipsoid ascospores, with straight germ slits along the spore-length. Based on these morphological characteristics, the fungus was identified as *Biscogniauxia mediterranea*. Pathogenicity tests were conducted using an isolate of *B. mediterranea* on six-month-old *Q. brantii* seedlings using a mycelial plug of *B. mediterranea* colonized potato-dextrose agar and the symptoms were observed after two months and the same fungus was re-isolated. Based on previous studies infections occur in healthy living trees as endophyte and then become invasive under water stress conditions in most reports. B. mediterranea has been reported to be aggressive on drought stressed hosts. During the last ten years climate changes has occurred in Zagros forests and resulting drought stress extending desert areas followed by occurrence of the fine dust phenomenon has reduced the photosynthesis of the forest trees and making them more vulnerable to the disease. Despite tolerance of Persian oak species to the range of temperatures from -31°C until +45, the incidence of charcoal disease has been increased dramatically on *Q. brantii* forests. Based on our current knowledge, *Q. brantii* represents a new host of *B. mediterranea* and this is the first report of Persian oak charcoal disease outbreaks throughout Zagros mountain forests of Lorestan, Ilam, Fars, Kohgiloye va Boyer -- Ahmad and on Zelkova carpinfolia in Daland forests of Gorgan area.

Other Influence Factors on Decline Oak

The Iranian Water Crisis

Located in one of the most arid regions in the world, Iran has an annual average precipitation rate of 252 millimeters, approximately one third of the global average. Exacerbating the severity of water shortages, as much as 70 per cent of precipitation is lost to evaporation. Estimates suggest that lower-than-average precipitation in 2013 caused a 30 per cent reduction in the volume of water in dams across the country, with only five exceeding 90 per cent capacity. According to the Institute for Forest and Pasture Research, groundwater levels have dropped two meters in recent years across 70 plains, affecting as much as 100 million hectares. According to the UN Development Program, the level of Iran's per capita water resources is predicted to fall to as little as 816m^3 in 2025, down from2,025m^3 in 1990.

Iran is divided into six key and 31 secondary catchment areas. Besides the Persian Gulf and Gulf of Oman Basins, all of Iran's basins are in the interior, where renewable freshwater sources are limited. Close to half of Iran's total renewable water is in the Persian Gulf and Gulf of Oman Basins, representing one quarter of its land mass. Conversely, the Markazi Basin covers more than half of Iran's land mass but holds less than one-third of the available freshwater.

Climate Change

Forest development is expected to be affected by the expected change in climate in response to the rapid increase of greenhouse gases in the atmosphere, particularly carbon dioxide (IPCC, CO2) (2001). Climate change will alter the abiotic conditions under which plant species can establish, survive, reproduce, and spread. These effects are expected to increase plant stress and decrease survival in the drier, warmer, and lower elevation portions of species ranges [16]. Abiotic factors probably constrain the range of many invasive plants and limit their successful establishment [13,19]. With climate change, however, new habitat, once too cold or wet, may become available, enabling plants to survive outside their historical ranges and expand beyond their current ranges.

Climate change impacts, while not a direct cause of Iran's current water scarcity, will exacerbate water shortages and reduce already limited rainfall. According to Massoumeh Ebtekar, head of Iran's Environmental Protection Organization, Iran's climate has already warmed by 1.5 to 3 degrees due to greenhouse gas emissions. The seventh biggest greenhouse gas producer in the world, Iran is ranked 114th of 132 countries in the 2012 Environmental Performance Index produced by Yale and Columbia Universities. Of concern are Iran's water resources and air pollution.

Climate change induced temperature and precipitation variability will reduce available freshwater and increase the incidence of drought conditions. Traditional *Qanat* systems are better equipped to store water and prevent evaporation; while reliance on dams and reservoirs for water supply will lead to greater surface water loss through evaporation and lack of storage capacity. Estimates suggest available water could halve between now and2050 due to climate change [20]. If this occurs Iran will face severe water insecurity and current tensions are likely to intensify, leading to internal conflict, mass internal displacement and urban migration, and a severely degraded agricultural system. The impacts of such events on Iran's economy, environment, citizens and governance would lead to considerable instability in an already unstable region [21].

Water Scarcity

Food security is closely linked to water availability, which is claimed to be increasingly insufficient for agriculture, livestock, and household use in the villages. Extended dry seasons and deforestation have affected the water supply. Farmers now need to carry water from sources one to three kilometers away, further exacerbating the burden of food production (Figure 11).

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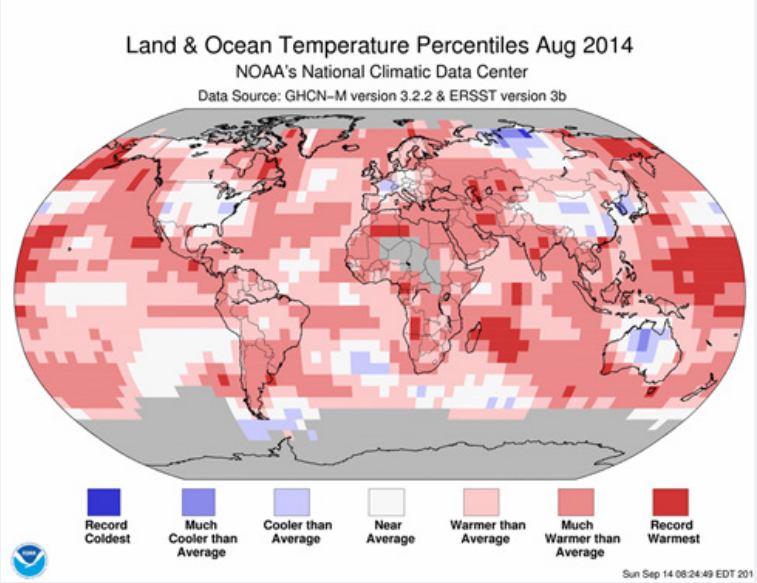

Figure 11: Percentile of land and ocean temperature in world.

Dust

Dust storms import up to 200 to 500-million-ton mineral dust particles into earth atmosphere in all over the middle east, Asia and Sahara [22] they affect directly visibility and have daily influence on military and economical operations in dust storms susceptible regions. Hence to identify this phenomenon aspect is necessary in respect to its enormous outcomes. Dust is one rooting cause of oak decline in Zagros forest. Recently, the occurrence of dust storms has taken on new dimensions and this issue has become a serious regional crisis. Fars province is one of the areas that is affected by this phenomenon. The deterioration of surface vegetation cover may strongly influence the occurrence of dust storms in Zagros Mountain [22].

Stress Complexes

In the context of the effects of climate change on ecosystems, sensitivity to disturbance interactions is extended to environmental drivers not usually identified as disturbances. For example, extreme temperatures, drought, and air pollution put forest ecosystems under stress, which may increase their vulnerability to "true" disturbances such as fire, insect outbreaks, and pathogens. Air pollution exacerbates drought stress from warmer temperatures, which amplifies biotic stresses such as insects and pathogens [23]. The stress complex for California forests is represented in (Figure 12); interacting disturbances form the core of drivers of ecosystem change, modified by climate, management, and air pollution.

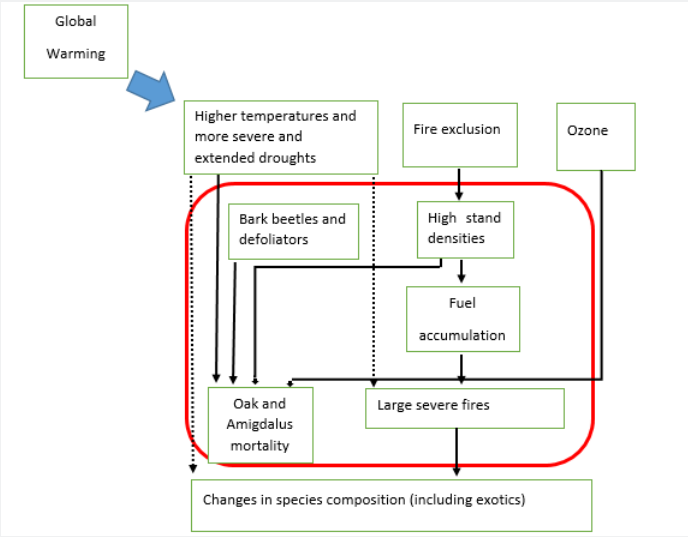

Figure 12: Conceptual model of stress complexes in Oak forests of the Zagros Mountain. The effects of insects and fire disturbance regimes and of fire exclusion are exacerbated by higher temperature. Stand-replacing fires and drought-induced mortality both contribute to species changes and invasive species.

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Drought

Projections of drought extent over the next 75 years show that the proportion of global land mass experiencing drought will double from 15 to 30 % [24], and on most land masses, dry season precipitation is expected to decline by 15 % [25]. The oaks as a group are quite tolerant of drought, primarily because they have large root systems, leaf morphological characteristics that reduce transpiration, and the ability to maintain gas exchange and net photosynthesis to comparatively low levels of leaf water. The development of a strong taproot system in oaks provides them access to moisture from deep soil layers, a source less available to their more shallow-rooted competitors. The oaks are better adapted to xeric environments than many of their common mesophotic competitors. Impacts associated with extreme events such as heat waves, extreme precipitation or storms, may strongly affect the carbon cycling in agriculture, forestry and natural ecosystems (Figure 13).

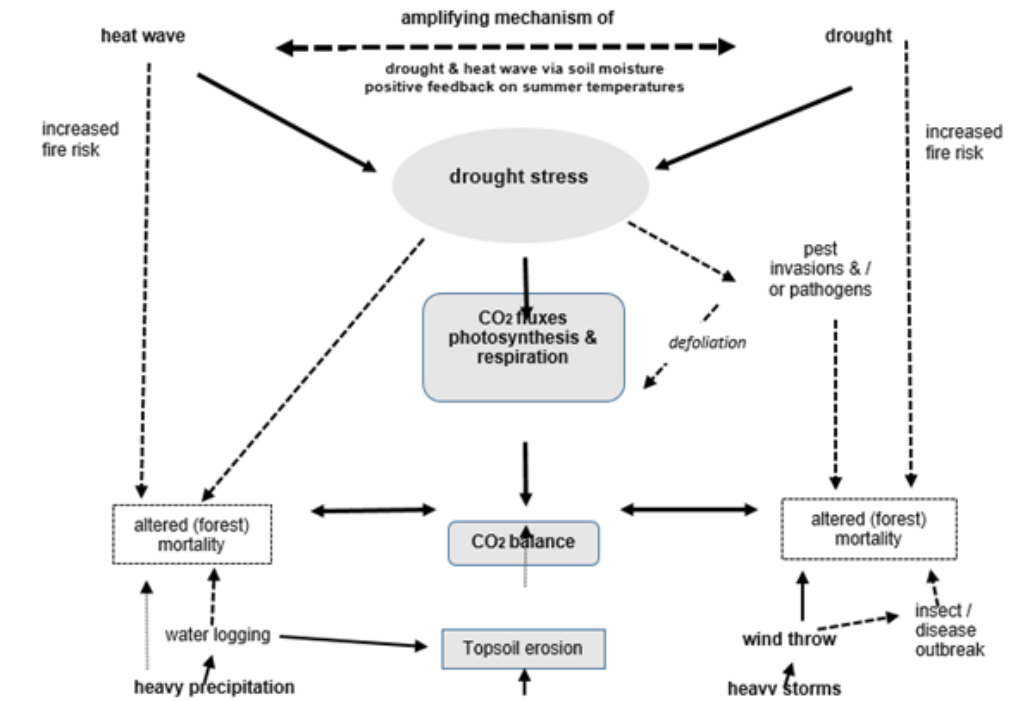

Figure 13: Impacts of climate variability and extremes on the carbon cycling of forest ecosystems. *Dashed arrows* show indirect and lagged effects.

Wood Production

Turkey and Iran are the main producers of wood products in Middle East and have established considerable plantations in areas with higher wood productivity for production purposes.

Wood Production

There has not industry wood in Zagros Forest, except to woods that will acquired of agroforestry of farmers in agriculture land that is mostly poplar tree (trembling poplar tree, *populous alba and populous nigra*).

Wood fuel

Firewood is a byproduct of forest management operations that comes from maintenance pruning, sanitary felling, and thinning (Figures 14 & 15). The linear function estimates published by Montero et al. [26] relate firewood yield to oak tree diameter, both for firewood resulting from pruning and from tree felling treatments. Thinned trees are assumed to have a diameter 35–40 % lower than the average diameter of the holm oak stand, with a 75 % firewood yield, based on lower intensity management than the empirical data used by Montero et al. [26].

Figure 14: The wood obtained as by product of maintenance pruning can be used for posts, firewood, or in charcoal preparation (Photograph by author).

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Figure 15: Wood posts gleaned from the pruning of oak trees in the Zagros forest. After curing, these are used for fencing (Photograph by author).

Charcoal

Three wood properties appear to be important when considering the effectiveness and efficiency of charcoal production methods: woody species traits, wood dimension, and wood moisture content (FAO 1985). Broad-leaved species deliver the best charcoal due to their high wood density and high lignin content. For example, oak (*Quercus*) meets processing requirements quite well.

The method known as the 'traditional earth pit' is the most common processing tool applied in the Talamanca Mountains. This is probably the oldest method to produce charcoal in the world [27]. Normally, a large pit is dug in the forest ground (often in pastures) and properly sealed with soil material. The size of the pit differs from place to place, depending on the availability of raw material and the practices of the villagers. For the purpose of the current study, the cavity (earth pit) assessed was designed to fit the same amount of wood (4m3 wood) as that consumed by the transportable metal kiln (Figure 16).

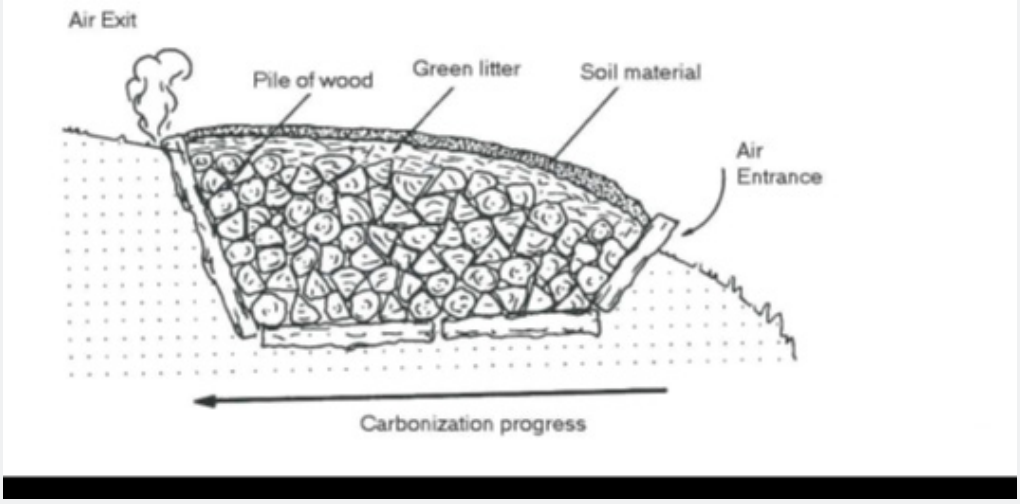

Figure 16: A model of the earth pit in which charcoal is produced in a traditional way.

Even higher, at elevations of 2,700–3,000m, oak forest has been cleared for charcoal production. This was still a major source of income for farmers. Charcoal is produced mainly based on oak (*Quercus branti*) and to a lesser extent, orange spp. Today, the production of charcoal from living trees is prohibited by national legislation. Therefore, charcoal producers currently uncover decaying oak logs still scattered around in pastures.

Non-Wood Forest Product (NWFP)

In the Zagros forest and Zagros paramour grassland environments, poor peasants gather cloves and damask rose for ornamental arrangements, especially in the period before the spring season. These non-vascular plants are locally important as non-timber forest products (NTFPs) of considerable commercial value. They are sold to truck drivers who take them to urban markets ('*ferias*') in plain-Barm, Fars. Although all landscape units provide some medicinal value, the forest was by far the most important, contributing over one third of all value. More than 15 per cent of medicinal products derive from gardens or the village itself. The tragacanth gum is an important commercial gum produced by several shrubby plants of the genus Astragalus, particularly in Zagros Forest, Iran. About 70% of the supplies of tragacanth gum originate from Iran, but small quantities are also produced in Afghanistan. Iran's average annual production potential is estimated at 400tonnes and in 1988 export was 142tonnes which increased to 257tonnes in 1990. Tragacanth gum is mainly exported to the EU, US, Japan and the countries of the former Soviet Union [28]

Firewood and Acorn Yields Other of Damage Factors

Silvopastoral management of oak woodlands provides fuelwood from oak and shrub clearing or tree pruning, fodder (acorns, grass and browses), cereal fodder in long rotations, wild game, honey, and other diverse private goods and services [29].

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Economy Zagros

Enough annual rainfall allowed agriculture without irrigation in much of Persia. Agriculture within Zagros forest is not a recent occurrence and has been well established for centuries. The economic crisis in many developing countries has reduced the purchasing power of low-income families and limited even further their ability to pay for formal sector housing or services. Many households in peri-urban areas do not enjoy a regular income. As noted above, families settle in peri-urban areas for rational reasons, primarily because land prices or rents are low.

Climate change in Zagros Mountain, Iran will have social, political, and economic implications, which will be determined in large part by existing structural conditions and long- term trends. Although there has been significant diversification of the economy in recent years, Zagros people still depends heavily on agriculture. Unfortunately, in one decade soaring drought and change climate sent Zagros's economy into a tailspin, severely constraining public- sector spending. Rising average temperatures in and of themselves will not significantly affect the Zagros forest states: the region is already one of the moderate, cold places on the planet.

Iranian Livestock

The Zagros of western and southwestern Iran is a mix of agronomic, social, and economic traits that forms a time-tested agrosilvopastoral system involving about less half the Iranian free-ranging livestock. Forests play an important role in the livelihoods and welfare of a vast number of people in both developed and developing countries; from urban citizens taking a recreational stroll in a nearby forest to isolated hunter gatherers who live in and off the forest. Livestock population numbers are high, and the domestic production of feed is limited. Livestock production in the Zagros Forest is an important part of the forestry production system. Livestock provides a major source of income in the drier areas where agricultural production is limited, and a supplementary source of income in areas where rainfall is better but erratic. For example, in Iran, livestock population is estimated at three times the feed production capacity of the rangelands. The result is that the traditionally organized forest grazing, with low livestock numbers on agreed rotations, is now breaking down as the pressure on the forests has significantly increased.

Population Growth

Population growth and its consequences on land use, in addition to land degradation and price shocks, are already a major concern for sustained forest and agricultural productivity in the region. The trend of changes in temperature, precipitation and climatic extremes will add to this stress. The agriculture of the region is potentially vulnerable to environmental and climate changes, and this threat can severely affect food security. The predicted temperature increase beyond 3ؚC in most regions [29] is likely to have very adverse impacts on agriculture, water resources, ecosystem production and human health [30]. In Iran population has doubled since 1979, and the demand for more agricultural and pastoral products has forced people to convert forest and rangelands into cultivated land, and to overuse wood and plants as fuel for household cooking and heating [31].

Agriculture

The most obvious reason for deforestation is the conversion of forest lands for cattle ranching and agricultural crops, industrial activities and logging for timber. Transportation infrastructure has been linked to aggressive and rapid change in land use, with new roads making previously remote areas of forest accessible to farmers and ranchers, thus facilitating conversion of forest land to agricultural crops and use as pasture. Deforestation rates in Zagros forest have again been rising encouraged by record world prices for agriculture products, pushing the agricultural frontier ever further into Zagros forest. Global climate change has already contributed to rising temperatures in the Zagros forest which, when combined with deforestation, have led to a cycle of lower precipitation and a greater frequency of droughts. Conversion of oak forests to pomegranate gardens are rooting causes of destroy of its forests.

Tribes

Tribe living along Zagros forest (Figure 9). Tribes are people that migrate in ever seasonal for providing of diet for livestock. In autumn and summer, they are in plain –Barm forest, kazerun, thus they will migrate to colder some Abadeh and Eghlid city. During the pre-contact era oak trees were plentiful and served as a staple food source for most tribes. Tribes of the Barm Plains lived similar than those of the other Zagros mountain forest Basin did. Tribes of the same language Family lived in the same environment. Many tribes were organized into clans, clusters of related families traced back to a common ancestor. Ghashghae tribe live in Zagros forest with members from other area tribes. Ghashghae is largest and most populous in Iran. Inhabitant's farm, raise livestock, cut lumber, and are generally self-sufficient. They still practice traditional customs, such as hunting, fishing, acorn-gathering, basket making, beadwork, and the White Deerskin and Jumping dances. Other tribal members earn a living through farming, raising livestock, and leasing oil rights to their lands. Livestock, especially sheepherding, soon became essential to Zagros tribe economy. Keep in mind that each tribe has a detailed history and culture to be further explored.

Each has individuals who have made or who are contributing to their own people or to the general society through leadership and in art and literature. Also keep in mind that each tribe has its own worldview and ceremonials.

Grazing

The effects of livestock grazing on the oak woodland community vary widely according to timing, intensity, and livestock type. Not surprising, responses to grazing are highly variable among plant and animal species.

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Vegetative elements important to wildlife (e.g., grass, woodland shrub cover, and litter biomass) may be reduced, changed structurally, or otherwise altered by livestock grazing [32]. Grazing can reduce small mammal abundance [33]. And can alter the foraging behavior of wild herbivores such as deer [34]. Several studies conducted in the Southwestern US and in California oak woodland suggest that well-managed grazing systems can benefit native plant and wildlife species. For example, native perennial grasses were found to benefit from being grazed by cattle and sheep [35], and Marty [36] reported higher richness of aquatic invertebrates and native plants in continuously grazed vernal pool grasslands than at ungrazed sites in Central California oak woodland. Several endangered species are known to benefit from grazing, including San Joaquin kit foxes (Vulpes macrotis mutica) [37], and Stephen's kangaroo rats (Dipodomys stephensi) [38]. Weiss [39] found that grazing was necessary to maintain habitat suitability for the endangered Bay checkerspot butterflies (Euphydryas editha bayensis). It has been argued that if livestock are properly managed, desired goals of animal production, economic sustainability, and wildlife conservation can usually be achieved [40].

Goats, Sheep and Cattle

Figure 17: Forest grazing is in fact a free good for the livestock producer in Zagros Forest (Khosroshirin village, Fars. Photo by author).

In Zagros the forest and scrubland grazed is estimated at 5 million ha. Livestock production is a main economic activity, both in high rainfall areas where it represents a secondary production system, but more so in areas of limited rainfall where, in many cases, it represents the primary source of revenue. Livestock production provides insurance when crops fail. In addition, goats are a preferred source of protein as they are more readily transportable (Figure 17).

Fire

The use of fire as a management tool in agriculture and rangeland, combined with public apathy, neglect in fire management, arson, the irresponsible behavior of tourists and picnickers, and social conflicts are the main causes of uncontrolled fires, which burn significant areas of forest every year [41]. Although direct mortality from exposure to heat or smoke is quite rare, fire indirectly affects animals by its effects on habitat. As Wirtz et al. [42] documented for small mammals, longer-term response to fire varies among species and is proportional to the alteration of the habitat. In the post-burn years, wildlife composition moves toward species adapted to the level of complexity of the habitat created by the fire. Careful use of prescribed fire in oak woodland to mimic historical fire intensity and fire regimes can promote biodiversity at the landscape level [43]. Possible similarity between the effects of fire and of livestock grazing on habitat was proposed recently as a research hypothesis by Purcell and Stephens [44-47]. Much will be gained by a more thorough understanding of how grazing can be managed to influence woodland habitat structure in a manner like that of prescribed burning. Air quality regulations, risks to property, and cost are making prescribed burning more difficult to implement. In summary, prescribed fires of low intensity can help to maintain woodland habitat mixes and their associated diversity, either alone or in combination with low intensity grazing. More research on this topic is clearly needed, however (Figure 18).

Figure 18: Fire in Plain-Barm forest, Kazerun in 2014 to area100ha. (Photograph by Author).

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References

1. Comprehensive Geography of Iran (1987) Ministry of Education publication, Iran.
2. Darehshouri BF, Kasraian N (1998) Nature of Iran. Rowzaneh Kar Publication, Tehran, Iran.
3. Ellison A M, Bank M S, Clinton B D, Colburn E A, Elliott K, et al. (2005) Loss of foundation species: consequences for the structure and dynamics of forested ecosystems. Front Ecol Environ 3(9): 479-486.
4. Loo J A (2009) Ecological impacts of non-indigenous invasive fungi as forest pathogens. Biol Invasions 11(1): 81-96.
5. Paine R, Tegner M, Johnson E (1998) Compounded perturbations yield ecological surprises. Ecosystems 1(6): 535-545.
6. Turner M G (2010) Disturbance and landscape dynamics in a changing world. Ecology 91(10): 2833-2849.
7. Woodall C W, Grambsch P L, Thomas W, Moser W K (2005) Survival analysis for large- scale forest health issue: oak decline. Environ. Monitoring and Assailment 108(1-3): 295-307.
8. Pedersen B S (1998) Modeling tree mortality in response of short- and long- term environmental stresses. Ecological modeling 105: 347-351.
9. Oosterban A, Nabuurs G J (1991) Relationship between oak decline and groundwater class in the Netherlands. Plant and soil 136(1): 87-93.
10. Asensio D, Peñuelas J, Ogaya R, Llusia J (2007) Seasonal soil and leaf CO_2 exchange rates in a Mediterranean Holm oak forest and their responses to drought conditions. Atmos Environ 41(11): 2447-2455.
11. Maxime Cailleret, Marie Nourtier, Annabelle Amm, Marion Durand Gillmann, Hendrik Davi (2015) Drought-induced decline and mortality of silver fir differ among three sites in Southern France. HAL journal.
12. L J Haavik, A D Graves, T W Coleman, M L Flint, R C Venette et al. (2014) Suitability of native and ornamental oak species in California for Agrilus auroguttatus. Entomologia Experimentalis et Applicata 150(1): 86-97.
13. Pauchard A, Kueffer C, Dietz H (2009) Ain't no mountain high enough: Plant invasions reaching new elevations. Frontiers in Ecology and the Environment 7(9): 479-486.
14. Clinton B D, Boring L R, Swank WT (1993) Canopy gap characteristics and drought influences in oak forest of the CoveetaBasing. Ecol 74(5): 1551-1558.
15. Kabrick J M, Dey DC, Jensen R G, Wallendorf M (2008) The role of environmental factors in oak decline and mortality in the Ozark Highland. Forest Ecol Manage 255: 1409-1417.
16. Allen C D, Breshears D D (1998) Drought-induced shift of a forest-woodland ecotone: Rapid landscape response to climate variation. Proceedings of the National Academy of Sciences 95(25): 14839-14842.
17. Prieto P, Peñuelas J, Llusià J, Asensio D, Estiarte M (2009) Effects of experimental warming and drought on biomass accumulation in a Mediterranean shrubland. Plant Ecol 205(2): 179-191.
18. Ogaya R, Peñuelas J (2007) Tree growth, mortality, and above-ground biomass accumulation in a holm oak forest under a five-year experimental field drought. Plant Ecol 189(2): 291-299.
19. Alpert P, Bone E, Holzapfel C (2000) Invasiveness, invasibility and the role of environmental stress in the spread of non-native plants. Perspectives in Plant Ecology, Evolution and Systematics 3(1): 52-66.
20. Yazdanpanah M, Dariush Hayati, Gholam Hosein Zamani, Fereshteh Karbalaee, Stefan Hochrainer-Stigler (2013) Water management from tradition to second modernity: an analysis of the water crisis in Iran. Environment, Development and Sustainability 15(6): 1605-1621.
21. Sinéad Lehane (2014) The Iranian Water Crisis. Global Food and Water Crises Research Programme. Independent strategic analysis of Australian global interests.
22. Tegen I, Fung I (1994) Modeling of mineral dust in the atmosphere: sources, transport, and optical thickness. J Geophysics Res 99(D11): 22,897-22,914.
23. Ferrell G T (1996) The influence of insect pests and pathogens on Sierra forests. In Sierra Nevada Ecosystem Project: Final report to Congress. Assessments and scientific basis for management options 2(45): 1177-1192.
24. Burke E J, Brown S J , Christidis N (2006) Modeling the recent evolution of global drought and projections for the twenty-first century with the Hadley Centre climate model. Journal of Hydrometeorology 7: 1113-1125.
25. Solomon S, Plattner G K, Knutti R, Friedlingstein P (2008) Irreversible climate change due to carbon dioxide emissions. Proceedings of the National Academy of Sciences 106: 1704-1709.
26. Montero G, Martín D, Campos P, Cañellas I (2000) Selvicultura y producción del encinar(Quercus ilex L.) en la comarca de Monfragüe. CSIC-INIA-UCM Internal working paper, CSIC-INIA-UCM, Madrid, Spain p. 47.
27. FAO (1985) Industrial charcoal making, UN Food and Agricultural Organization, FAO Forestry Rome, Italy.
28. Food and agriculture data (2010) FAOSTAT.
29. Aminmansour M (2004) Drought and desertification in Iran, Iran & Iranian Latest News Persian, Iran.
30. Sabanour (2008) Complementary exploration report on iron deposits in Hamedan and Kurdistan.
31. Edwards SW (1992) Observations on the prehistory and ecology of grazing in California. Fremontia 20(1): 3-11.
32. FAO (2015). Managing forests for climate change.
33. George MR (1991) Grazing and land management strategies for hardwood rangelands. In: Standiford RB (ed) Proceedings Symposium Oak Woodlands and Hardwood Rangeland Management. US Dep Agriculture, Davis, USA pp. 315-319.
34. Helama S, laanelaid A, Raisio J, Tuomenvirta H (2008) Oak decline in Helsinki portrayed by tree- rings climate and soil data. Plant soil 319(1-2): 163-174.
35. Hitz S, J Smith (2004) Estimating global impacts of climate change. Glob Environ Ch 14(3): 201-218.
36. Johnson MD, Horn CM (2008) Effects of rotational grazing on rodents and raptors on a coastal grassland. West N Amer Natur 68: 444-452.
37. Jones A (2000) Effects of cattle grazing on North American arid ecosystems: a quantitative review. West N Amer Natur 60(2): 155-164.
38. Kie JG (1996) The effects of cattle grazing on optimal foraging in mule deer (Odocoileus hemionus). Forest Ecol Manage 88(1-2): 131-138.
39. Martin R E, Sapsis D B (1991) Fires as agents of biodiversity: pyrodiversity promotes biodiversity. In: Proceedings Symposium biodiversity of northwestern California. University California Wildl Res Center, Berkeley, USA pp. 150-157
40. Marty JT (2005) Effects of cattle grazing on diversity in ephemeral wetlands. Conserv Biol 19: 1626-16322.
41. Nogués Bravo D, M B Araujo, M P Errea, J P Martnez Rica (2007) Exposure of global mountain systems to climate warming during the 21st Century. Global Environmental Change 17(3-4): 420-428.

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42. Ogaya R, Pen U J (2007) Tree growth, mortality, and aboveground biomass accumulation in a holm oak forest under a five-year experimental field drought. Plant Ecol 189: 291-299.

43. Purcell KL, Stephens SL (2005) Changing fire regimes and the avifauna of California oak woodlands. Studies Avian Biol 30: 33-45.

44. USFWS (United States Department of Interior Fish and Wildlife Service) (1997) Draft recovery plan for the Stephen's kangaroo rat, Region 1. United States Department of Interior Fish and Wildlife Service, Portland, Oregon, USA.

45. USFWS [United States Department of the Interior Fish and Wildlife Service] (2010) San Joaquin kit Fox (Vulpes macrotis mutica) 5-Year review: summary and evaluation, United States pp. 37-38.

46. Weiss SB (1999) Cars, cows, and checker spot butterflies: Nitrogen deposition and management of nutrient-poor grasslands for a threatened species. Conserv Biol 13(6): 1476-1486.

47. Wirtz WO II, Hockman D, Muhm JR, Souza SL (1988) Post fire rodent succession following prescribed fire in southern California chaparral. In: Management of amphibians, reptiles, and small mammals in North America. Szaro RC, Severson KE, Patton DR (tech coord) USDA Forest Service, Fort Collins, United States pp. 333-339.

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