

The Spatial Valuation Pattern of Co2 Absorption Function in Caspian Forests of Iran

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Extended Abstract

Ecosystems provide goods and services that contribute to human welfare, and provide an environment in which ecological process take place. Economic theories predict that ecosystem goods and services for which there are inefficient markets, tend to be underrepresented in management decisions and their supply will be sub-optimal. Ecosystem Degradation not only has many negative impacts on economic condition, but also has many negative effects on future sustainable economic growth. One of the most important reasons for this degradation is lack of market for ecological goods and services.

On the other hand, estimating the real value of these functions is an essential need for achieving the appropriate allocation of natural resources. Valuation can be effective in obtaining the social decisions, in the assessment of cost and benefit, accept or reject of the project, or determine appropriate and acceptable level of damages to the environment.

Also in national income calculations in macro level, awareness of the value is required, because usually in the process of economic development ecosystem goods and services are not entered in the calculations and often results in wrong patient to provide statistics such as GDP indices.

Knowing the values plays an effective role in people's and policy makers' attention to the environment. In fact, the fundamental point is that the value of ecosystem service is not the solely aim but it is a "decision support tool" to a better decision making in environmental filed.

Forests as one of the most important terrestrial ecosystems provide the highest number of ecosystem services and there is no market to present their values. Among these non market services, gas regulation is the most important issue. Forests are carbon stores, and they are carbon dioxide sinks because plants absorb CO₂ and use it in photosynthesis process. This process, in addition to producing plant biomass and releasing O₂, has an effective role in reducing the greenhouse effect. In the recent years there are a lot of concerns with this phenomena and it causes global warming with a lot of significant effects. Amongst the world forests, tropical forest stands the highest in carbon absorption.

There is not a spatial similarity in CO₂ absorption because of the difference in plant concentration, tropical situation, kinds of specious and the amount of plant annual growth per hectare. Therefore, spatial valuation can distinguish between these differences and shows the heterogeneity in these areas.

In this study we introduce a pattern to achieve spatial distribution of CO₂ absorption with geographical information system in a part of Caspian forests of Iran.

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Caspian forest, with an average area of 1.8 million hectare is located on the north of Iran, near the Caspian Sea, and it is divided to many watersheds. Fig 1 shows the study area location.

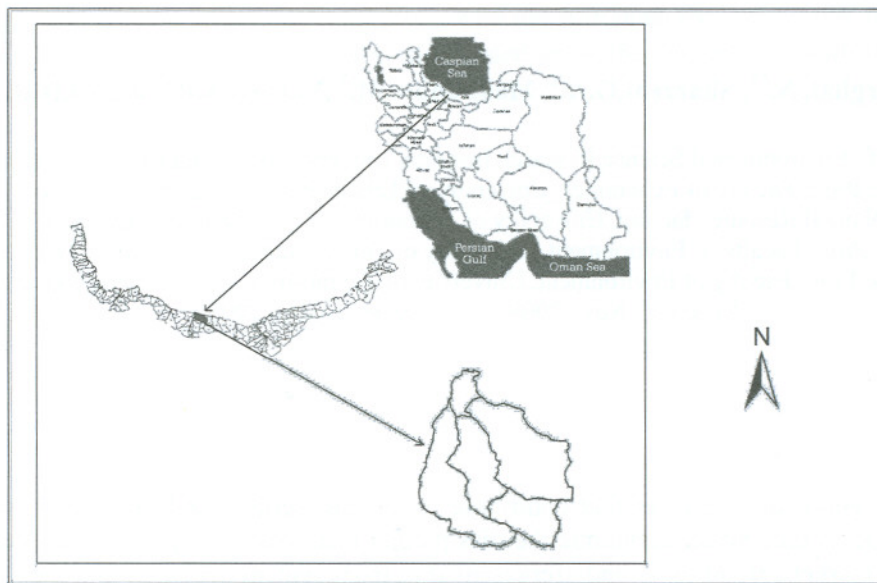


Fig. 1: Location of the study area in comparison to the Caspian forests and Iran country

There are a relationship between land characteristic and the value of ecosystem services. A pattern has been introduced among these two items. To achieve this pattern, First of all the forest type map has been generated. Then the map of annual growth per year has been established according to the average growth of each plant type in a ten year period. By employing the density of each plant type, the growth map of annual produced plant biomass has been introduced. The relationship between plant biomass and CO_2 absorption has been calculated by photosynthesis formula. According to this formula plants absorbs 264 gram CO_2 and produce 162 gram amylase (plant biomass).



The map of carbon absorption has been generated according to the relationship between the produced amylase and the absorbed carbon dioxide. This map shows that there is a great difference between different parts of the area in CO_2 absorption. Finally the ecosystem function of CO_2 absorption has been valued with replacement of the cost method. There are other evaluation methods like carbon marketing, substituting the cost method and carbon tax, for evaluating the CO_2 absorption value. Replacement cost method is one of the most important cost based methods in environmental economics. This method is based on the cost of replacing the natural services with a man made services.

We use the cost of industrial carbon capture and storage for replacing the natural value of CO_2 absorption.

Carbon capture and storage (CCS) is a mean to mitigating the contribution of fossil fuel emissions to global warming, based on capturing carbon dioxide (CO_2) from large point sources such as fossil fuel power plants, and store it away from atmosphere by different means.

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The largest CO₂ storage project to date has been injecting approximately 1 million tones of CO₂ per year since 1996 into a saline formation. According to the IPCC report, the average cost of CCS in 2007 was around 63/3 US\$ for each ton of carbon dioxide. In this pattern according to kinds of species, plant concentration and growth per hectare, we achieve the map of spatial distribution of CO₂ absorption value.

Planners can Use this map, as a decision support tools, for more careful local and regional planning. A comprehensive forestry plan for Caspian forest can help planer to create integrated map of CO₂ absorption value in the Caspian forest, but studies show that only 45% of north forest of Iran has a comprehensive forestry plan, that unfortunately in some of these projects many shortcomings are facing.

Results show that in the study region with an area of 20582 hectare, the value of CO₂ absorption is more than 8 million Dollars per year. It is important to note that this amount is only one of several valuable ecosystem services that forests ecosystems provide. Fig 2 shows the map of carbon dioxide absorption value in the study region.

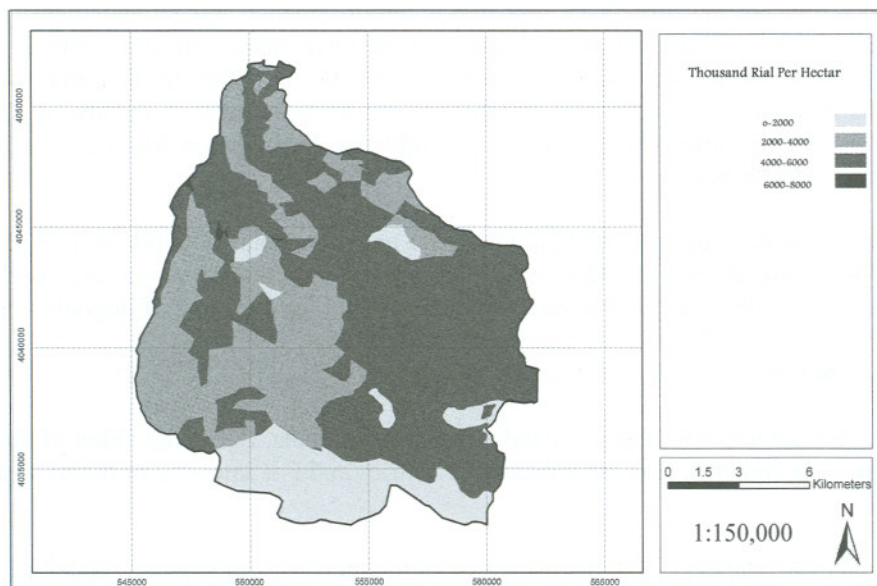


Fig. 2: The map of carbon dioxide absorption value in the study region

This study shows that the economic value of carbon absorption is significant. Also the CO₂ absorption value is more than 6 times different from one place to another place in the study region, it shows that the spatial deference plays as important role in evaluation and it is not appropriate to consider the whole area as a similar zone. Accessing the spatial value in ecosystem services can help planners and decision makers to have more accurate evaluations and it may help them for more sustainable management of the forests.

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Key Words

Economic Valuation, Ecosystem services, Carbon Dioxide, Global Warming, Kheirod Kenar