Relationship between Normalized Difference Vegetation Index (NDVI) NOAA-AVHRR and some meteorological elements.

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Abstract

The relationship between NDVI and some meteorological parameters and the vegetation in Mongolia have been studied. The purpose of this study is to show the relation between the satellite and ground station data. We found a relationship between NDVI and temperature, NDVI and precipitation in Mongolia. NDVI values are based on decadly and biweekly data.

Introduction:

NOAA-AVHRR data in the Red and near Infrared are sensitive to calculate the NDVI, which is useful to monitor the crop area and crop growth/stages throughout the crop growth cycle. Thus the temporal NDVI may be considered as an important crop elements. The vegetation growth is an indicator of soil moisture. NDVI derives from satellite data and presents the growth and development of agricultural crops and pasture. Normally, when studying the vegetation and crops, only station's data have been used. In this paper, we try to connect the satellite and the ground data.

Methodology:

For vegetation cover the most commonly applied satellite-derived parameter is the Normalized Difference Vegetation Index (NDVI), calculated from the visible (red, channel 1) and near-infrared (channel 2) reflectivity's of the Advanced Very High Resolution Radiometer (AVHRR) flown on board the polar orbit NOAA satellites.

$$NDVI = (NIR-RED) / (NIR+RED)$$

We used also some simple models in calculations at the monthly and sum NDVI for the vegetation period in Mongolia and a regression analysis in

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order to show the relationship between NDVI and some agrometeorological elements (temperature, rain and etc).

Used data:

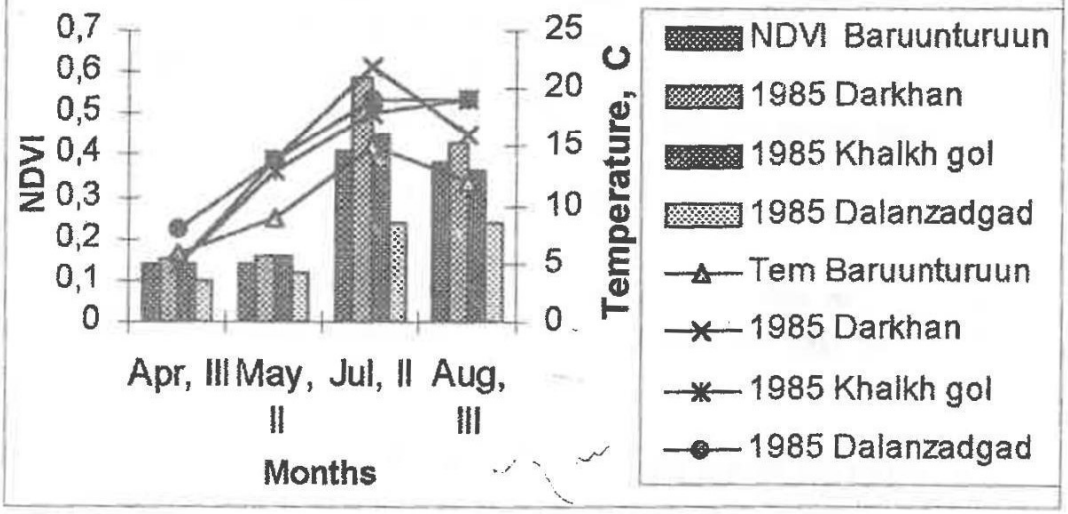
- NDVI decadly (10 days) data (NOAA AVHRR) from the Local Area Coverage (LAC) between 1984 - 1991.
- NDVI biweekly data from CD ROM between 1985 - 1991.
- Spring wheat crops in Mongolia between 1984 - 1991.
- Decadly rain during the vegetation period.
- Decadly temperature for crop growth period.
- Latitude and longitude of four stations of Mongolia.
- Geographic, Administrative, Natural zoning, Soil, Cultivated areas maps of Mongolia.

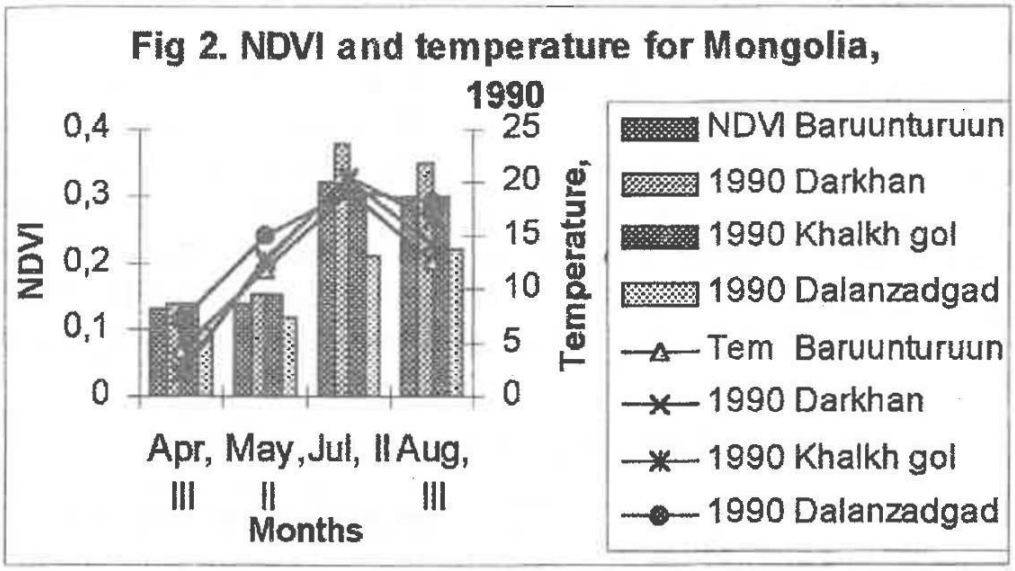
Results and discussion:

NDVI and Temperature.

In this study we have plotted graphs for NDVI and temperature (Fig 1, 2) for four periods of the growing period in good and bad years. These figures show that the temperatures were different in the beginning of the growing period. In other words, in 1990 the temperature was about 2 times higher than in 1985. It means that the weather conditions during this period show effective impacts on growth and development of plants. If the weather condition have been good in the beginning of the growing period, it means that the root system of the plants has developed well.

Fig 1. NDVI and temperature for Mongolia, 1985

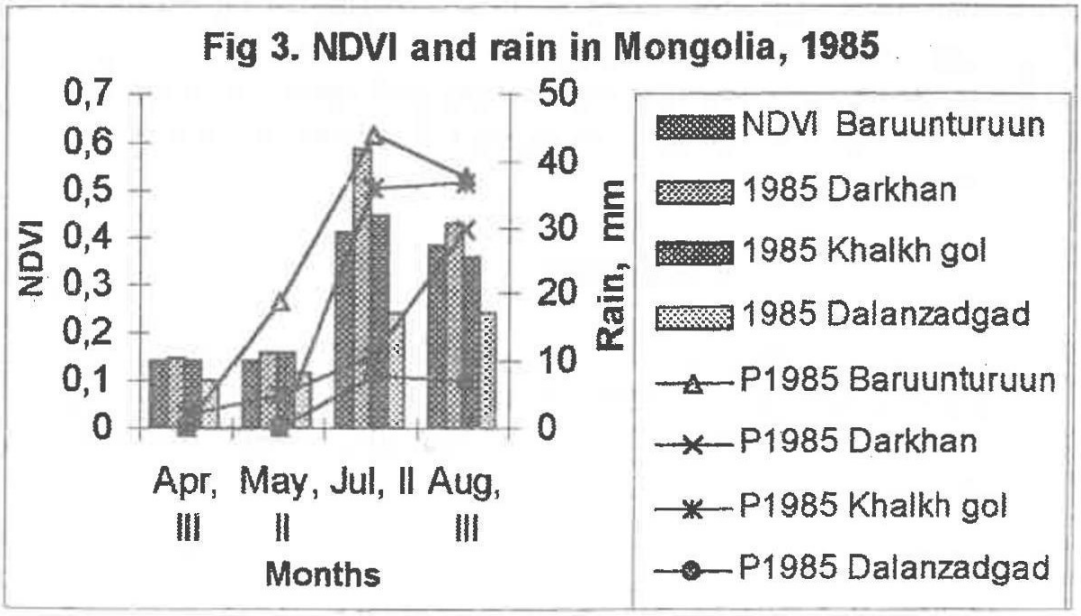




We tried to calculate the relationship between these two parameters, but we could not observe a good relationship because of the lack of data. In the future, we will continue to study the relationship between NDVI and temperature.

NDVI and rain.

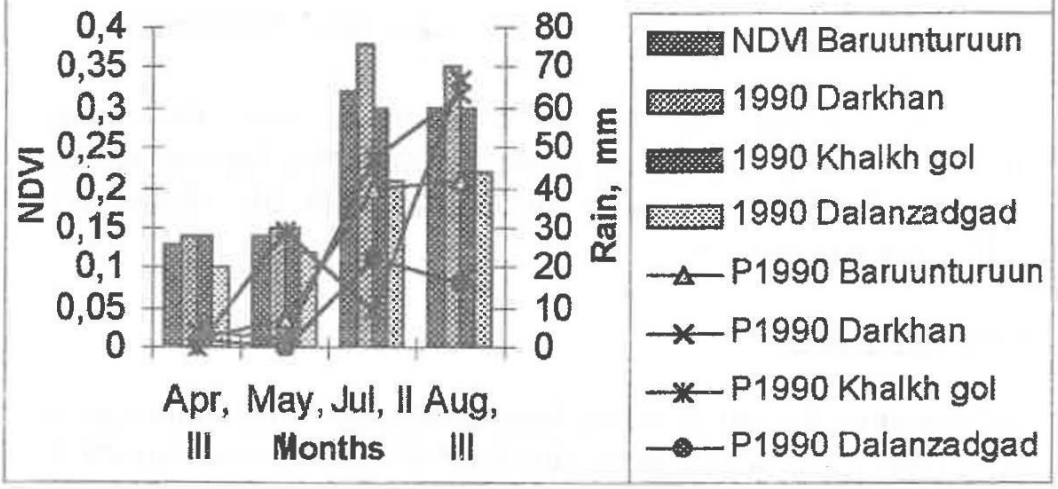
In Mongolia, the soil moisture depends strongly on rain during the spring and summer seasons. Therefore, this kind of study is very important. The NDVI and monthly amount of rain from April to August in 1985 and 1990 are plotted in figures 3 and 4. These figures show that in the beginning of the growing period the amount of rain is different. Khalkh gol station in May 1990 received sufficient amount of rain. In 1985 the Khalkh gol station observed less rain than in 1990. We must remember that this



region is not dominant in Mongolian agriculture, because the Eastern part of Mongolia has only little arable land.

The amount of rain at the Darkhan station, which is located in the central agricultural region of the country has recorded a small amount of rain in the beginning period of 1990 and, therefore, the collected yield was only small. The central agricultural region of Mongolia plays the dominant role in agriculture. During the July and August in 1990, the amount of rain was bigger compared to 1985. But the amount of rain during the July-August has only small influence to crop growth and development of plants.

Fig 4. NDVI and rain in Mongolia, 1990



At the Baruunturuun station in 1985 and 1990 the quantity of rain remains the same. This region has only a small role in Mongolian agriculture.

Even the Dalanzadgad station had more rain in 1990 than in 1985. But this is noncropped region. So, rain in the beginning of the growing period is very important for crops in Mongolia.

Therefore, we have to study the quantity and intensity of rain in different periods of the crop growing period and not the amount of rain for the growing period.

Conclusions:

- NDVI can be used in the estimation of growth and development of plants in Mongolia.
- NDVI and temperature have a relationship during the crop growing period.

- NDVI and rain have a positive relationship. It means the vegetation depends on precipitation during the growing period.

Товчлол:

Энэ өгүүлэлд хиймэл дагуулын мэдээгээр гаргасан ургамлын ургалтын индекс ба газрын станцын хэмжилтээр авсан агаарын дундаж температур, хур тунадасны хооронд орших хамаарлыг судлах зорилго тавьсан билээ. Эдгээр хэмжигдэхүүнүүдийн хооронд хамаарал оршиж байгаа нь харагдлаа. Ургамлын ургалтын индекс агаарын дундаж температуртай урвуу, хур тунадастай шууд хамааралтай байна. Судалгааны дүнг тодорхой харуулахын тулд 1985, 1990 оныг сонгосон болно.

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