ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 8, Issue 7 , July 2021

Optimization of Land and Crop Types in Rainfed areas of Uzbekistan

Ruziboev Sobir

PhD student and assistant at the Tashkent Institute of Irrigation and Agricultural Mechanization Engineers

ABSTRACT: After independence, Central Asian countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) have experienced a slight decline in food production and an increase in imports of such products from other countries. However, since the 2000s, all Central Asian countries have embarked on a path of sustainable agricultural production. This has slightly improved the food supply of the region. Introduction of new agrarian policies has shown its bright positive results, especially in the Republic of Uzbekistan. At the same time, the proper management of the use of irrigated lands and the use of rainfed lands has to some extent paid off. With the help of GIS tools this study has learned further possible optimization of rainfed lands to help increase food production to meet food security in the country.

KEY WORDS: Central Asia, Optimization, Rainfed lands, GIS.

I. INTRODUCTION

Rainfed lands are the lands where agricultural products are grown due to natural precipitation. Rainfed lands often have an annual rainfall of 250-300 mm in the study area where there are hills, foothills, and mountainous areas. In such zones, agricultural products are grown mainly in exchange for moisture accumulated in the soil as a result of precipitation in the autumn, winter and spring months. Drought-tolerant cereals, fodder crops, horticulture and viticulture are grown in those areas (Mukumov et al). Recent scientific research sources indicate that in recent years, due to the withdrawal of irrigated arable land from agricultural production for various objective and subjective reasons, rational use of those areas and meeting the growing demand for food remains one of the most difficult problems of the economy. Therefore, in order to solve this problem, it is necessary to increase the efficiencies of use of irrigated and rainfed lands to increase the productivity of rainfed lands through introduction of innovative approaches to establish of orchards and vineyards, walnut orchards, pistachio-almond orchards. As an innovative approach we have divided mountainous areas into different zones using GIS technics in our study area. This would help to identify which crops to cultivate in which zones to get potential yields. Because, the amount of annual natural precipitation plays a great role together with the altitude of the place above sea level. The higher altitude the area, the higher the rainfall. This situation increases the level of natural moisture supply to the rainfed lands of this region, which improves the water and nutrient balance of the crops grown there. Considering of abovementioned, the productivity of rainfed landcould be higher in mountains than the productivity of rainfed lands in the plains or hills. This natural factor should also be considered in the implementation of projects related to the organization of land use. This will help decision makers making valuable decisions for future land use planning and crop allocations. Therefore, the purpose of this research is to study and analyse the current state of land use and learn ways of optimizing the types and areas of land and crops in such areas, and to develop methodological and practical proposals for improving better land management.

II. STUDY AREA

Study area is in Kashkadarya province of Uzbekistan. Kashkadarya (wikipedia)region located in south-eastern part of the country and this region borders with two central Asian country Tajikistan and Turkmenistan, and with other local provinces of Uzbekistan which are Samarqand, Bukhara and Surkhandarya. Yakkabag district is one of the potential districts to develop rainfed agriculture to produce more food from arable land located in this region. Agricultural production in this district especially for rainfed area is merely depends on amount of precipitation and rainy seasons. To make proper crop diversification and proper crop cultivation we had to involve GIS tools to see and classify in geographical extent. Below image shows location of Study area in Uzbekistan.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 7 , July 2021

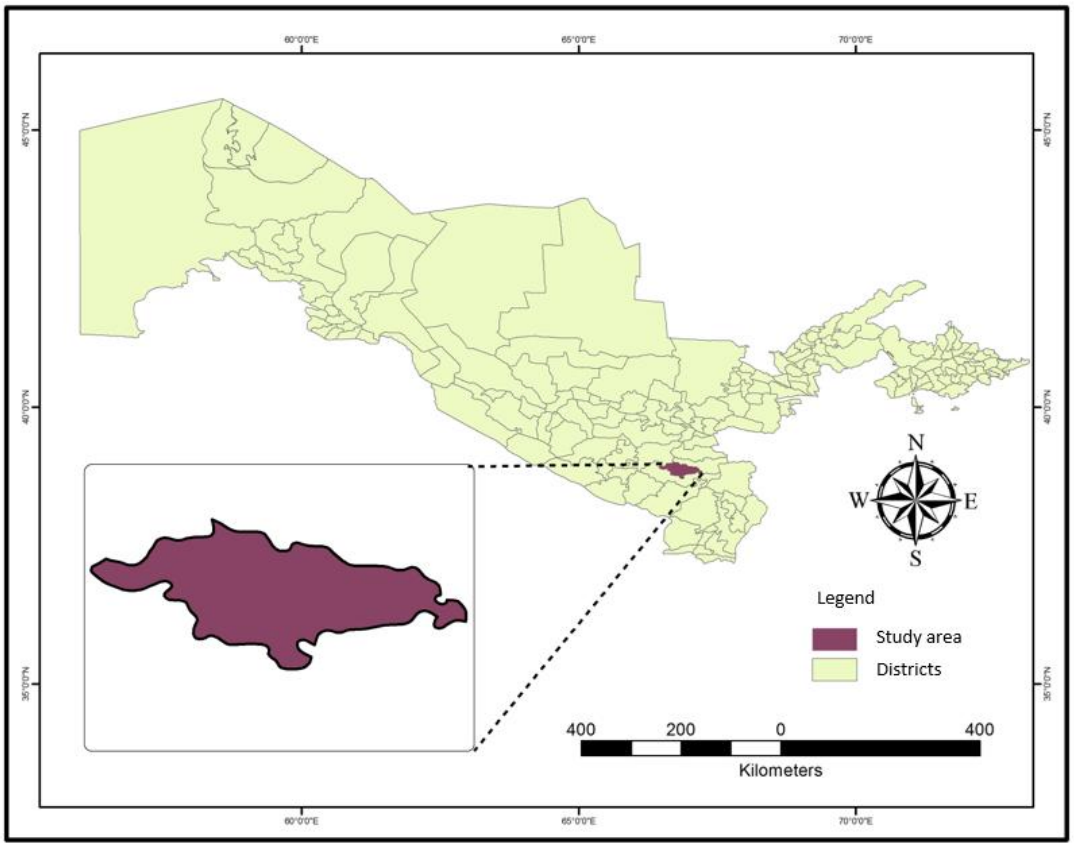

Fig.1. Study area (author developed)

III. DATA AND MATERIALS

In order to make proper assessment and zoning to different appropriate areas, we have collected high resolution digital elevation model from ALOS PALSAR (ALOS) with 12.5 meter of pixel resolution. With this dataset we have done 3D model of the study area and classified into different zones providing nationally accepted zoning rules for rainfed areas. Below image is an example of where we have been able to retrieve DEM data.

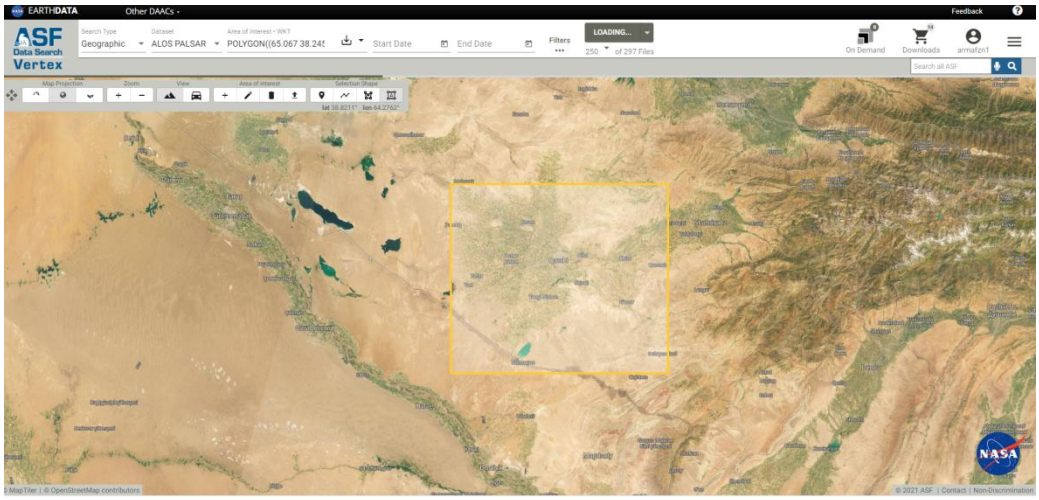

Fig 2. Interface of Alos Palsar datasets

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 8, Issue 7 , July 2021

IV. METHODOLOGY

Availability of DEM data does not mean that we have the results of the study. This simple DEM data must be processed and prepared properly for further assessments. DEM data is not only colour image, but it has vast amount of digital numbers which helps us to further delineate into different zones.

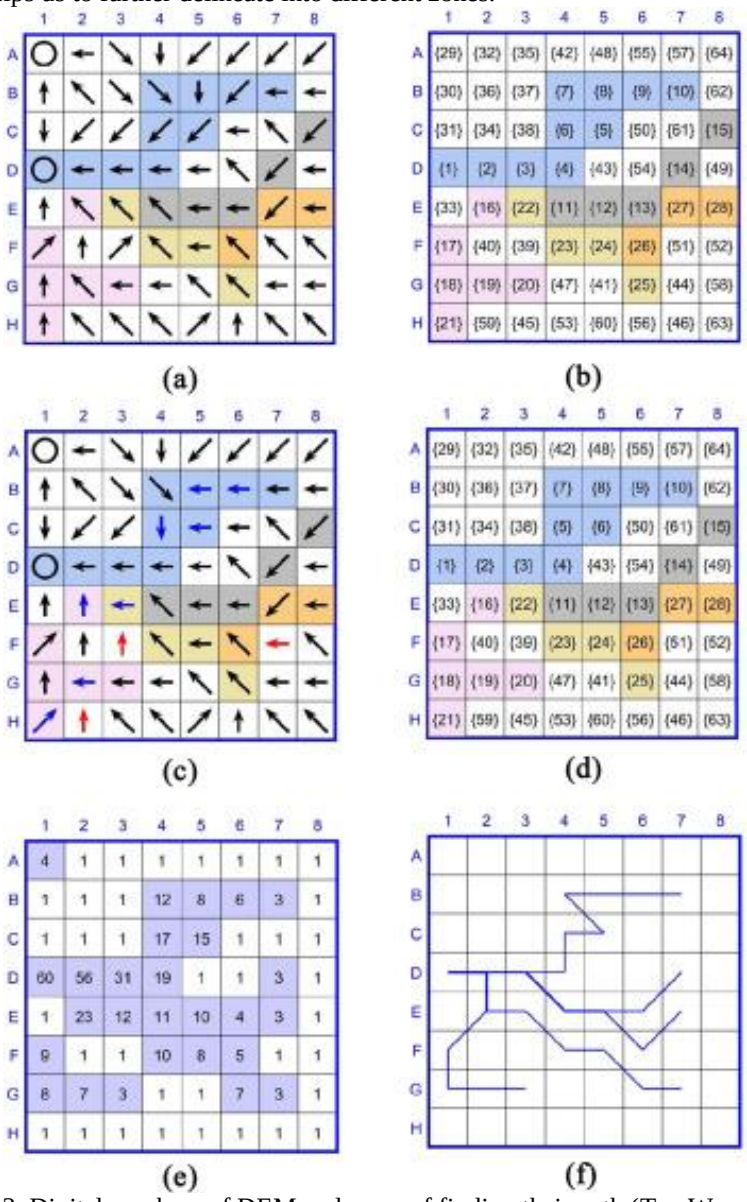

Fig 3. Digital numbers of DEM and ways of finding their path (Tao Wu et.al)

Image above illustrates DEM datasets as pixel and digital numbers. This numbers allow us to play with to get target result depending on what researchers want. It can be extraction of drainage networks and preparing river maps, development of contour lines or making Slope maps and so on. To do these tasks, the number in each pixel plays an important role where GIS tool can easily read this numbers and upon the threshold criteria the required maps will be created. This will help to easily visualize any geographical extent in different colours to get more understandable picture of the location.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 7 , July 2021

Using DEM data, we have divided our study area into 4 different zones.

1. Plain rainfed zones
2. Plain rocky and hilly zones
3. Foothills rainfed zones
4. Mountain and high mountain rainfed lands

Table 1. Zoning criteria and level of precipitation

Zone names	Height (m)	Precipitation (mm)
Plain rainfed zones	350-400	250-300
Plain rocky and hilly zones	400-600	300-350
Foothills rainfed zones	600-1000	350-450
Mountain and high mountain rainfed lands	1000-1200	>400

V. EXPERIMENTAL RESULTS

Based on above given criteria using GIS tool we have divided our study area into four different zones. Below map illustrates the zoning of various altitude.

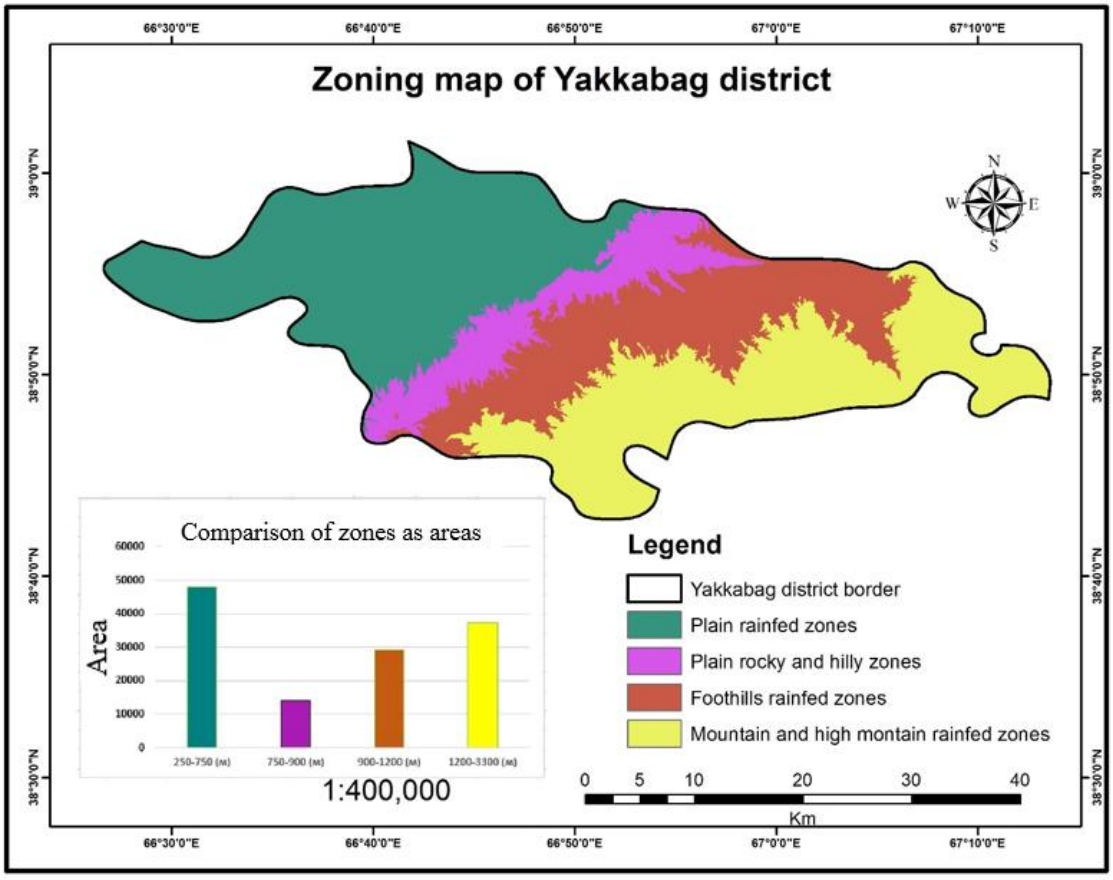

Fig 4. Zoning map of study area (author developed)

The exposition or aspect map of slopes in the region also plays a key role in wise management if the use of rainfed lands. This factor is especially obvious in dry lands, which are widespread in mountainous areas. In particular, the moisture accumulated as a result of autumn and spring precipitation on the southern and south-western slopes, if not maintained by special measures, it disappears much earlier than in other directions at warm temperatures, and on the

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 7 , July 2021

northern and north-western slopes the accumulated natural moisture is retained for a long time. Therefore, the proper use of this factor in rainfed lands can play an important role in increasing their productivity.

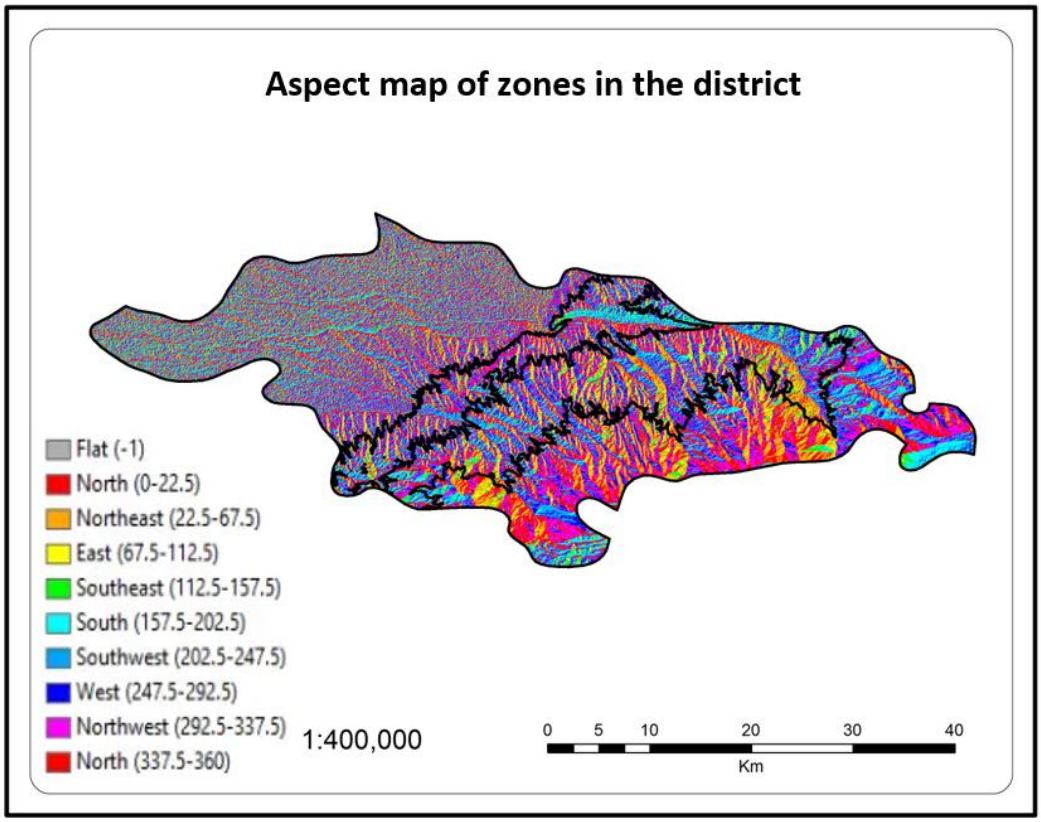

Fig 5. Aspect map of the study area

Considering the relief and aspect of the place. The main rule in the design and technical preparation of land is to place the long side of the field across the slope. In this case, the main work to be done along the long side of the field is done in the horizontal direction (across the slope). This prevents the process of water erosion in the soil, because the water flowing over the surface is retained in the treated soil, well absorbed, which has a positive effect on crop yields, especially in arid regions.

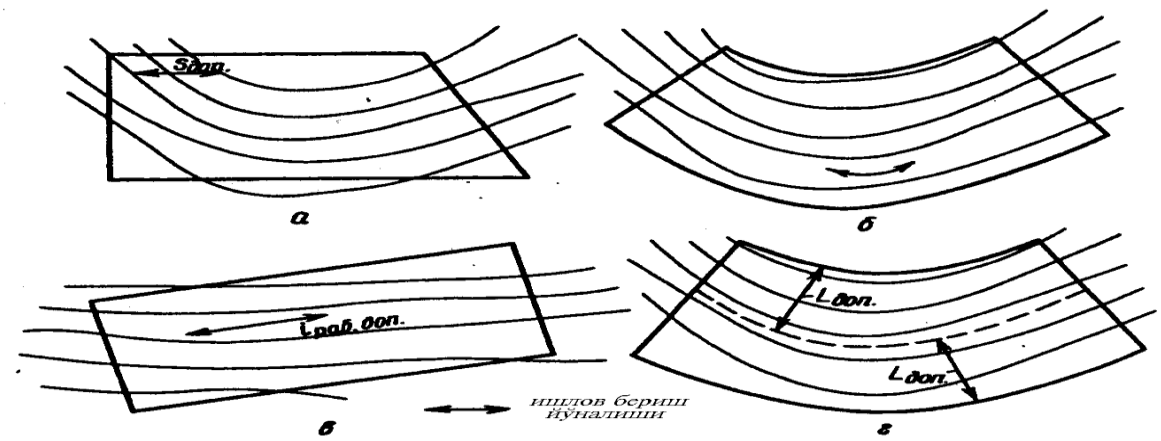

Fig 6. Land preparation process in high slope zones

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 8, Issue 7 , July 2021

VI. CONCLUSION AND FUTURE WORK

The results show innovative approach to the development of rainfed lands design aimed at the rational and efficient organization of dry lands which shows a clear picture on how to proceed with organizational duties to cultivate these types of lands. This helps for decision makers in the future to produce as much agricultural products as possible on such lands based on this research findings and put such lands into agricultural use. This will help to radically increase the income of farmers on such lands and produce more food. This effort can be considered as initial step and can be even more optimized and enhanced to establish better assessment tools for such zones. Future work could further improve current study considering this as baseline study.

REFERENCES

[1] Alaska Satellite Facility User Services https://asf.alaska.edu/information/how-to-cite-data/

[2]Tao Wu, JiayeLi, TiejianLi, BellieSivakumar, GaZhang, GuangqianWang(2019) High-efficient extraction of drainage networks from digital elevation models constrained by enhanced flow enforcement from known river maps

[3] Mukumov Abdugani Muratovich, Usmanov Yusuf Alikulovich, Ruziboyev Sobir Boymirzayevich, Majitov Bakhrom Khamidovich. THE WAYS TO INCREASE THE EFFICIENCY OF DEKHAN AND HOUSEHOLD PLOTS.

[4] Wikipedia, https://en.wikipedia.org/wiki/Qashqadaryo_Region

[5] World Land Resources www.fao.org/publications

AUTHOR'S BIOGRAPHY

Mr. Ruziboev Sobir is an assistant at the department of land management of the Tashkent Institute of Irrigation and Agricultural Mechanization Engineers. At the same time an independent PhD student at above affiliation. His research interests relate to land management and land use and their optimal optimizations of sustainable land management systems in the region. He actively participants in the regional and international conferences and seminars.