Bio-physical and socio-economic indicators related to land degradation: A case study of Rupandehi district in Nepal

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ABSTRACT

Land degradation is one of the major environmental problems worldwide. Land degradation highly affected agriculture and livelihoods of farmers in Rupandehi district, Nepal. Primary information was collected through structured questionnaire of household survey by selecting the samples randomly. Most farmers depending on agriculture have a perception of land degradation. They are practicing both agricultural and non-agricultural adaptations according to their capacity and skills at local level. This study has recommended conducting awareness program and providing modern agricultural skills to the farmers to minimize land degradation and food scarcity. The study also emphasized on increasing the agricultural production to meet food demand of the growing population through agricultural intensification and intensive use of agricultural inputs.

Key words: Bio-physical and socio-economic indicators, land degradation, agriculture, Rupandehi district.

INTRODUCTION

Nepal lies near the northern limit of the tropics with snow peaks including Mount Everest (8848 m) on the northern frontier stretched out from east to west. The plain land (Terai) lies on the south and is elongated from east to west. This constitutes a very wide range of climate from summer tropical hot and humid atmosphere in the Terai to the colder dry continental and alpine winter climate throughout the middle and northern mountainous areas. The monsoonal rainfall patterns in Nepal are highly affected by the orographic effects causing some parts of the country more susceptible to floods and landslides, and others prone to drought. The rainfall pattern in the country is often erratic and the country experiences either a short or long dry spell each year even within the wet season affecting the normal crop production system.

Land degradation is attributed to fragile geology and is accelerated by anthropogenic activities along with increased population, inappropriate farming practices including shifting cultivation in the hills slopes. About 28.24% of the total land (about 3.2 million ha) is under the process of desertification in one way or the other. Of the total degraded land, the forests and the rangelands comprise of more than 70%. Most of the forest in the Mid-hills are under community management and are well managed (Kanel et al., 2004). Forests in the Terai, Siwaliks, and High Mountains are under severe pressure from biotic interferences. In general, forests under government management face high degree of degradation. Of the total forest area of the Terai districts about 1.3 million ha is degraded. Likewise, about 40% of the forests, mostly in the high mountains have crown cover less than 40%. The situation of pasture land is even worse and high mountain pasturelands (about 50%) are affected by transhumance grazers since centuries.

The area of land under the process of degradation is also increasing. The computed data showed the annual loss of soil from 182 to 708 million tons/year where the contribution from severely degraded forests and rangelands exceeds 88% of the total loss. This clearly indicates that rangeland or open land is severely affected by degradation and a significant amount of productive soil along with loss of nutrients (N, P and K). The forest area has
been converted into degraded lands and vegetation cover is extremely low in some areas. Also mass wasting is a common phenomenon in the geologically fragile hills thereby increasing the area of degraded lands (MoEST, 2006). Land use and land cover changes affect directly and indirectly the environment, economy and society at various spatial and temporal levels. Land use changes include forest clearing, industrialization, tourist facilities, infrastructure development and urbanization. Land use starts with land cover modifications that alter the physical and chemical composition of environmental receptors (air, water, and biota); these trigger a host of economic and social impacts that lead to further land use and land-cover changes resulting in environmental degradation. Rapidly growing population, urbanization and industrialization lead to the dramatic change of land use and cover structure (APN, 2011). Some policy and legislation related to land use, agriculture and climate change of Nepal are: Land Act, 1964; Soil Conservation Act 1982 and Regulations 1985; Forest Act, 1993; Agriculture Perspective Plan, 1995; National Adaption Plan of Action (NAPA) on Climate Change, 2010; Climate Change Policy, 2011; National Land Use Policy, 2012.

Irrigated land in the hills and mountains are well terraced, while the majority of upland is poorly terraced. Cultivation of land having more than 30\(^\circ\) sloped is common in the hills and mountains. Overall productivity of land has declined annually in most of the physiographic regions despite several measures taken to improve soil fertility by various agencies. As a result, more marginal land is brought under cultivation. This has induced soil erosion, landslides and loss of property. Use of the chemicals and decline in the use of traditional organic manure has changed the soil characteristics through increased soil acidity, salinity and water logging.

Out of the total area covered by the forests (1,011,362 ha or 88\%) excluding protected area, 38, 132 ha (12\%) is degraded in the plain areas of Terai (DoF, 2004). Forests are depleted through anthropogenic activities such as cattle grazing (about 32\%) and firewood collection and loping (28\%). The grasslands, except for the alpine meadows, are under heavy grazing pressure (Pariyar, 1993). The mid-hills and the open grazing lands are stocked by about 13 times more than its carrying capacity and the steppe grazing lands by about 19 times, whereas the alpine meadows are under-stocked. The alpine meadows are grazed only in the summer season (3 to 4 months a year).

From the perspective of species diversity in wild habitat, Nepal occupies 26\(^\text{th}\) position and 11\(^{\text{th}}\) position on the global and continental basis respectively (MFSC, 2006). Eight species of fish, 29 species of butterflies, 9 species of amphibians, 108 species of spiders, 2 species of birds and 1 species of mammal are endemic to Nepal. However, 11 species of birds and 3 species of mammals are believed to be extinct due to habitat destruction and/or alteration (MOPE, 2004). From farmer’s perspectives, rivers originating from lower Himalayas or Mahabharat and Siwaliks are destructive and damage land, forest, and lives or property while big rivers when they enter into the Terai or plain area cause huge damages through flooding and sedimentation.

The major source of energy is the traditional energy (87.7\%) followed by commercial energy (11.8\%) and renewable energy (0.5\%) of the total energy consumption in 2004/2005. It indicates the continued dependence on traditional energy which includes fuel wood (89\%), agriculture residue (4.3\%) and cattle residue (6.6\%). Nepal has identified land degradation and desertification as the principal environmental problems which require most urgent actions. Other environmental problems such as forest depletion, water pollution, solid waste disposal, ground water depletion, biomass use, and trans-boundary movement of hazardous wastes also contribute to the degradation of land and water systems.

Land degradation and loss of agricultural productivity is a major challenge because Nepal’s land resources are very fragile and prone to degradation both inherently and in response to human activities. Rugged mountains topography, high intensity rainfall, and active geological processes contribute to a high level of natural process of degradation. A product of geological and climatic conditions, the resource degradation and associated environmental consequences are part of the natural process of mass wasting in the region (Ives, 1987). In addition, population pressure has led to the subdivision and fragmentation of holding, declined in the area of land per capita, disguised unemployment and marginal productivity. Agriculture land rapidly being converted to residential area, industrial area and even for infrastructure development that has led to degradation of land, loss of productivity and decline in the status of natural resource base (Bhattarai and Adhakari, 2013).

The productivity varies with the natural factors like Climatic (e.g. light, temperature, rainfall, wind speed, humidity and atmospheric pressure, radiation), topographic (e.g. altitude, direction of mountain chains and valleys and steepness and exposure of slopes), edaphic (e.g. soil and its physical and chemical properties) and biotic factors like plants, animals and micro organisms increasing or decreasing the production (Reddy, 2002). This research aims to study the bio-physical and socio-economic indicators related to land degradation in a Rupandehi district of Nepal.

**MATERIALS AND METHODS**

**General description of the study area**

Rupandehi district, a part of Lumbini zone (Figure 1a), is
one of the seventy-five districts of Nepal. This district lies in the western Terai region of the western development region of Nepal. Geologically, it is divided into Chure (14.5%), Bhabar (0.6%) and Terai (84.9%). Its area is 1360 km². It is situated between 27° 20’ 00” to 27° 47’ 25” N latitude and 83° 12’ 16” to 83° 38’ 16” E longitude. The elevation ranges from 100-300 m and the total population is about 708419 (CBS, 2006).

VDCs such as Ekala, Madhawaliya, Karahaiya, Makrarahar, Masina, Saura Pharsatikat, Gagedi, Amuwa, Ama, Suryapura, Madhubani, Bishnupura, Anandaban, Shankarnagar, Gongolia, Khadawabangi, Motipur, Selmear, Siktaham, Tikuligad, Sadi and a municipality that is Butwal are selected for the study (Figure 1b).

Methodology

This study relies on the primary data. Primary data were collected through a random sample survey of 21 VDCs and 1 municipality of Rupandehi district of Nepal from 16 to 23 October, 2008. The survey was conducted using a structured questionnaire under the direct supervision of the author. Data were collected from a sample of 171 farmers proportionately distributed among the areas. A field visit was done to check the information gathered during the survey. The data have been analyzed using SPSS and MS Excel.

The questions were selected so as to collect information about land degradation and some adaptation measures in the study area. Some of the major questions that were asked are presented below.

A. Awareness and Understanding
i. Are you familiar with the term land degradation?
ii. Do you feel any changes in weather (temperature/rainfall) system?
iii. Does land degradation have any consequences on your agriculture?

B. Land degradation and adaptation
i. What do you grow in your field? And what is the time for the plantation and harvest?
ii. Do you use chemical fertilizer or organic manure or both? If yes, please specify…….
iii. Do you encounter with weeds and pests that hamper yield? If yes how you control them, please specify……………………
iv. Have you noticed change in agricultural production over the past 10 years or so? If yes, please specify……………………………………………………
v. If there is change in agriculture production, in your opinion what are the causes of change in production and what did you do to increase the production?
vi. Are there any crops (species), which you plant 10 years ago and not planting now?
vii. Are there any Government Organizations/INGOs/NGOs workings for the agriculture improvement program?

C. Forest
i. Do you consume the forest products? If yes please specify purposes……………………………………………………
ii. What is the condition of the nearby forest? Is there any government and non-governmental organizations or
a. Percentage of male and female

**Figure 2.** Distribution of population.

Table 1. Distribution of monthly rainfall and temperature.

<table>
<thead>
<tr>
<th>SN</th>
<th>Months</th>
<th>Average Temperature (°C)</th>
<th>Average rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Maximum</td>
<td>Minimum</td>
</tr>
<tr>
<td>1</td>
<td>Jan</td>
<td>35.4</td>
<td>21.7</td>
</tr>
<tr>
<td>2</td>
<td>Feb</td>
<td>33.4</td>
<td>24.8</td>
</tr>
<tr>
<td>3</td>
<td>Mar</td>
<td>35.1</td>
<td>26.5</td>
</tr>
<tr>
<td>4</td>
<td>Apr</td>
<td>34.9</td>
<td>26.9</td>
</tr>
<tr>
<td>5</td>
<td>May</td>
<td>33.4</td>
<td>25.8</td>
</tr>
<tr>
<td>6</td>
<td>Jun</td>
<td>33.7</td>
<td>23.6</td>
</tr>
<tr>
<td>7</td>
<td>Jul</td>
<td>31.5</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>Aug</td>
<td>25.3</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Sep</td>
<td>21.2</td>
<td>11.2</td>
</tr>
<tr>
<td>10</td>
<td>Oct</td>
<td>23.1</td>
<td>8.7</td>
</tr>
<tr>
<td>11</td>
<td>Nov</td>
<td>25.6</td>
<td>10.2</td>
</tr>
<tr>
<td>12</td>
<td>Dec</td>
<td>33.3</td>
<td>12.4</td>
</tr>
</tbody>
</table>

Source: DHM, Bhairahawa Airport Station (2007).

D. Irrigation/water management

i. Is there any water scarcity during the crop production? If yes, when and how you manage, please specify......

ii. What are the sources for irrigation? What is the quality of water used for the agricultural land?

RESULTS AND DISCUSSION

Gender and religious diversity

A total of 129 farmers are selected from Aama, Suryapura, Madhubani, Bisnapura, Anandaban, Butwal, Shankarnagar, Gongolia, Khadabangai, Motipur, Semlar, Siktaham, Tikuligad, Sadi VDCs and 42 farmers are selected from Ekala, Madhawaliya, Karahaiya, Makrhar, Masina, Soura Pharsatikat, Gagedi, Amuwa VDCs. The male and female individuals are 129 and 42 respectively with different types of religion namely Hindu, Muslim and Buddhist (Figure 2). Majority of the respondents are age 30 and above. However, age of 19 years and 85 years old are also included in the questionnaire.

Bio-physical and social-economic parameters

Meteorology and hydrology

The maximum and minimum temperature recorded of this region is 43.7 and 8.75°C respectively (Table 1). The average annual rainfall is 1391 mm (CBS, 2007) (Table 1). The Potential evapotranspiration (PET) of Rupandehi district for the season August to November in which rice is grown is 99.7 cm. The value of crop coefficient (Kc) for rice is 1.33 and the value of aridity index (AI) is 1.16. High temperature and greater precipitation at the initial period
of rice growing season has increased the PET and lower temperature and lower precipitation has reduced the PET at late season during rice growing period. Al increases and decreases as increase in the days after plantation of Rice and reaches to a maximum during late crop development stage and reduce significantly at a period before harvesting. Kc decreases with increase in the days after plantation of Rice (Bhandari and Kayastha, 2012).

Irrigation

The timing and quantity of irrigation water to be applied are influenced by conditions such as the type of crop produced, type of soil, temperature, stage of plant growth, etc. In Rupandehi district, the soils are heavy clay and so drainage is more important than irrigation for successful crop production, especially during the monsoon and autumn seasons (Figure 3).

Forest resource

Forest increases the greenery in an environment. It absorbs CO₂ and mitigates the possibility of global warming, sea level rise and climate change. It provides habitat for wild animals and increases biodiversity. It controls erosion and even landslides too. Forest can fulfill timber, fuel, wood, and fodder demand of people and livestock sustainably if it is efficiently managed (Table 2) (Bhandari, 2013).

Agricultural yield

The Intergovernmental Panel on Climate Change (IPCC) has indicated an average rise of 3°C in temperature causing severe shortage of water that exerts pressure on crop yield (Garg et al., 2002). Rice (Oryza sativa L.), wheat (Triticum aestivum L.) and maize (Zea mays L.) are the major crops of the district (Table 3). Rice cultivation and related occupations, provides the livelihood for many people living in the country. Rice can grow on soil types that are not well suited for other crops. Rice can grow in areas that are waterlogged or inundated. Wheat research is coordinated by the National Wheat Research Program (NWRP), Bhairahawa. For higher yields, water requirements are 350-500 mm depending on climate and length of growing period in Nepal. There should be the adequate water during the establishment period. Water deficit during the filling period results in reduced grain weight. However, during the ripening and drying-off period, rainfall or irrigation have negative impact on the yield (Nayava et al., 2009). Yield of maize can be increased by providing sufficient moisture and manure, controlling disease and pests during initial, crop development and mid season (Bhandari, 2012).

The yield of rice and wheat has increased significantly ($R^2=0.62$ and $R^2=0.80$) and is in increasing trend whereas the yield of maize has not increased significantly ($R^2=0.01$) as shown in Figure 4.

Land use

Population pressure is a dominant factor in the utilization of land in a country. Generally, the practice of land utilization alters with change in the population size. Population growth changes the pattern of land distribution and its utilization (Table 4). Over the years, the growth population and international migration from hiss and mountains to the Terai regions or the urban areas of Nepal 

![Figure 3. Area coverage by irrigation sources in Rupandehi district (Ha).](image-url)
Table 2. Forest.

<table>
<thead>
<tr>
<th>SN</th>
<th>Indicators</th>
<th>Area (Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total area of Rupandehi</td>
<td>130735</td>
</tr>
<tr>
<td>2</td>
<td>Forest</td>
<td>26524</td>
</tr>
<tr>
<td>3</td>
<td>Well conserved forest</td>
<td>22187</td>
</tr>
<tr>
<td>4</td>
<td>Poorly conserved forest</td>
<td>4337</td>
</tr>
<tr>
<td>5</td>
<td>Shrub land</td>
<td>1613</td>
</tr>
<tr>
<td>6</td>
<td>Water resources</td>
<td>21</td>
</tr>
<tr>
<td>7</td>
<td>Arable cropped land and others</td>
<td>101924</td>
</tr>
<tr>
<td>8</td>
<td>Non-cultivated land</td>
<td>653</td>
</tr>
<tr>
<td>9</td>
<td>Deforestation in the past 10 years</td>
<td>1428</td>
</tr>
<tr>
<td>10</td>
<td>Afforestation in the past 10 years</td>
<td>647</td>
</tr>
<tr>
<td>11</td>
<td>Yearly deforestation rate</td>
<td>0.29 %</td>
</tr>
</tbody>
</table>


Table 3. Agricultural production.

<table>
<thead>
<tr>
<th>SN</th>
<th>Type of crop</th>
<th>Area (Ha)</th>
<th>Production (MT)</th>
<th>Yield (MT/Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rice</td>
<td>72500</td>
<td>221125</td>
<td>3.05</td>
</tr>
<tr>
<td>2</td>
<td>Wheat</td>
<td>32000</td>
<td>8800</td>
<td>2.75</td>
</tr>
<tr>
<td>3</td>
<td>Maize</td>
<td>2350</td>
<td>6110</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Source: District profile of Rupandehi (2007).

Figure 4. Trend analysis of rice, wheat and maize (1990-2003).

have brought the over use of agricultural land that lead to the degradation of land (Khadka, 2002).

Farmers’ perception of land degradation

Farmers understanding about land degradation largely differ. Overall, 95% of farmers have perceived the land degradation but are unaware of the science behind it. About 2% of farmers understand land degradation as the decrease in yield whereas 3% of farmers understand land degradation as the drought. Farmers believe that land degradation caused by factors like excessive use of chemicals (supported by 72% of the farmers), change in
Table 4. Land use.

<table>
<thead>
<tr>
<th>SN</th>
<th>Land use</th>
<th>Area (Ha)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arable cropped land</td>
<td>85122</td>
<td>60.21</td>
</tr>
<tr>
<td>2</td>
<td>Forest</td>
<td>32006</td>
<td>22.64</td>
</tr>
<tr>
<td>3</td>
<td>Pasture</td>
<td>8882</td>
<td>6.28</td>
</tr>
<tr>
<td>4</td>
<td>River</td>
<td>2460</td>
<td>1.74</td>
</tr>
<tr>
<td>5</td>
<td>Rocky surface, sand and gravel</td>
<td>414</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>Residential</td>
<td>5953</td>
<td>4.21</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>6530</td>
<td>4.62</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

Source: District Agriculture Office, Rupandehi.

land use pattern (supported by 58% of the farmers), migration (supported by 56% of the farmers), and increase in temperature (supported by 69% of the farmers) highly increased over the last 10 years.

Farmers report that they have observed the changes in regular rainfall pattern. The intensity and timing of rainfall has shifted resulting in erratic rainfall which leads to soil erosion (supported by 70% of the farmers). The changes in temperature and monsoon pattern have affected the flowering of crops and increased the number of mosquitoes and flies (supported by 96% of the farmers). Similarly, the incidence of disease Kalo poke (Black smut) has been increased in rice and loose smut in maize. Farmers recall that maize production was poor due to drought and they had confronted a big loss (supported by 90% of the farmers). They share that the use of organic manure is not sufficient to get good yield and have been using the chemical fertilizers like Urea, DAP, Potash (supported by 99% of the farmers). They also report that the use of chemicals is in increasing trend. Over use of fertilizers and pesticides destroys soil fertility (supported by 95% of the farmers) and increased the immunity power of the insects (supported by 79% of the farmers). However, 1% of the farmers follow organic treatment (Jholmal-spray prepared by mixing cattle urine, local herbal plants extracts such as Eupatorium sp., Tagetes sp. etc) during agriculture production to control pest and maintain fertility. Farmers reveal that they are getting encounter with new weeds and pests every year (supported by 80% of the farmers), for which they use different insecticides and pesticides in large amount (supported by 97% of the farmers). Farmers report that they have shifted to high yielding and modern/hybrid varieties and left using the local ones (supported by 99% of the farmers). They believe that hybrid seeds are high yielding than any other.

Farmers’ approaches towards adaptation

Farmers have also practiced conserving soil. They have planted some trees for minimizing the soil loss. Farmers have realized that they cannot solely depend on agriculture for their livelihood and are engaged in various agricultural and no agricultural activities such as services, business, labor work and abroad employments. Some of them also grow mushroom as an alternative source of income.

Cropping calendar

Human labor is used for soil preparation. Before plantation land is prepared by pulverizing soils to allow easier root penetration, to facilitate mixing manure and fertilizer, and to help destroy harmful insects and pests. Plantation and harvest differs with respect to different biophysical and socio-economic factors. In Rupandehi district, the time for the plantation and harvest of rice is 2 July and 16 November respectively whereas the time for the plantation and harvest of maize is 14 March and 15 June respectively. Similarly, the time for the plantation and harvest of wheat is 16 November and 15 March respectively.

Expectation of farmers

Farmers expect several types of supports. Among several types of expected new supports, farmers significantly expect moisture deficiency related innovations, crop development, infrastructural supports, and adjustment in wage. As the needs differ from farmer to farmer, more in-depth and specific requirement is possible to measure by categorical and individual type of variable analysis. Among all types of resource management innovations, 75% of the farmers expect water management innovation and 25% emphasize on the development of new crops or finding out varieties of crops. Among different types of logistics supports, subsidy in oil, seeds and fertilizers is considered important by 95% of the farmers. Moreover, 98% of the farmers agree that agricultural trainings are important to update them with the knowledge of farming techniques. The highest numbers of the farmers (80%) emphasize on the scarcity of human resource, agricultural tools and oil
during the plantation of crops.

The expectation varies from individual to individual. Among different types of external supports, the farmers setup the priority of supports based on the perceived importance of each categorical support to depend on agriculture. Farmers firstly need financial and encouraging supports (agreed by 50%). Secondly, they need information related supports (agreed by 40%). Thirdly, they need resource management innovation related supports (agreed by 30%). Fourthly, they need crop development related supports (agreed by 45%). Finally, they need production practice related supports (agreed by 40%). The priority setup is based on the highest number of choice for each category, which differs among farmers based on individual necessities.

Conclusion

The study finds that most farmers have a basic idea of land degradation and its cause. Most farmers understand that increases in number of weeds and pests, increase in use of chemicals, decrease in production are the results of land degradation. To cope with the situation and farmers are trying various methods to make high yield. However, these methods are not found to be sustainable. As a result, the agricultural sector of the district is becoming increasingly vulnerable, threatening farmers’ livelihood sustainability and food security. To enable farmers to resolve the land degradation, the very first important step required is to make them aware of the causes and the impacts. It will help them prepare their mindset to deal with land degradation and other socioeconomic stresses and think about how to respond in a more sustainable way. Moreover, the production practices of farms and individual farmers are needed to be kept up to date with the changes in climatic factors. They should also take all protection and be aware of the uncertainty of low rainfall and heavy rainfall. They must be careful in arranging proper water management, both in terms of irrigation facilities. Farmers in the study area, therefore, need necessary training and support from the government and the international agencies for better production of rice, wheat and maize. The financial management of farms and farmers too needs to be secured for a minimum of two seasons so that if the crop is damaged in one season, they will be prepared and have the seeds for the next season; their ability to bear the cost of another crop production will promise their survival by being financially sustained until the collection of the new crops. Farmers also need crop insurance facilities, but no such option is currently available at the time of the research.

The government of Nepal needs to check the significance of the necessity of farmers’ expectations of new supports from time to time to take appropriate steps and support the affected farmers. At last, it has been suggested to prepare a planned and proactive strategy in Nepal to secure a sound functioning of the economic, social and agricultural system.

RECOMMENDATIONS

Local level

i. Capacity of local community based organizations in the district should be strengthen and increase the awareness programs, trainings and initiate the community based adaptation measures to cope with the land degradation in a sustainable way.

ii. Farmers should adopt environment friendly methods for the cultivation.

iii. Farmers may explore the possibilities of perennial agriculture instead of rice, wheat and maize.

Policy level

i. Department of Agriculture should be able to forecast the seasonal insects and disease to minimize the loss of production.

ii. Nepal Government should focus the activities to support the management and distribution of resources, extension services and information dissemination to the local farmers.

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REFERENCES


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