

EFFECT OF FARMING PRACTICES ON WETLANDS OF KISII DISTRICT, KENYA

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Abstract. Effect of farming practices on wetlands in Kisii District was determined through assessment of farmers' environmental awareness. Effective conservation of wetlands in the district cannot depend on prohibitions but should be based on users' knowledge and attitudes of wetlands. The present study examined farmers' knowledge of the environmental effect of agricultural expansion to wetlands; absence of knowledge of characteristics of farming activities and the attitudes of farmers with respect to planning mechanisms that might be used to support wetland protection in the area. The majority of farmers ignored the effect of agriculture on wetlands. Those who occupied wetland areas practiced intensive agriculture and were ignorant of the effect of this on water quality, soil and landscape. The government should implement training programmes for all wetland users in Kisii District to make them more environmentally aware of the impacts of farming practices on wetlands. This is meant to make them become more environmentally aware of the effects of farming practices on these ecosystems and eventually change their behavior. There is a need to build a conservation ethic among wetland users by educating them to sustainably utilize wetland resources and training them to practise sustainable agriculture.

Keywords. *farming, wetlands, agriculture, environmental awareness, attitudes*

Introduction

Agricultural modernization has been taking place in Kenya over the last 40 years and intensified the agricultural production in the fertile farming areas. This process, while bringing production to record levels, has caused severe effects on the environment. Supporters of environmentally compatible agriculture emphasize the need to preserve the ecological balance of soil and water, secure food safety and maintain the health and quality of life for rural people and their communities.

Wetlands are fragile and valuable ecosystems supporting a diversity of species and habitats. They require environmentally compatible agricultural practice. Wetland degradation globally and appreciation of their ecological, economic and social values have generated a response from international and regional communities. In Kenya, drainage and conversion to arable cropping continue to degrade wetlands. By 1990, when Kenya ratified the Ramsar convention, most of the country's wetlands had been degraded. Drainage, land reclamation, overgrazing, eutrophication of inland waters caused by agricultural pollution are among the impacts of agriculture on Kenya's wetlands.

Responsibility for most of the above effects lies on the users of these areas, the farmers. These people, living in settlements close to the wetlands and earning their living from their resources remain alienated from the conservation policies, ignorant of the implications of their practices and uninformed of the new messages or the long-term benefits they could achieve. Even the few conservation projects in Kenya have not been adequately disseminated to the public.

Current farming practices in Kisii district and the impact on wetlands depends to a great extent on the level of environmental awareness, knowledge and attitudes of farmers. In Kenya, decisions critical for the future of wetlands are taken with no concern of farmers' knowledge of the harmful effects of their practices and the ways they can overcome them. Furthermore, farmers' involvement in the formulation of environmental policies or implementation of management plans for wetlands has been totally ignored by the government. It has been assumed that rural people do not understand the issues relating to resource conservation and cannot, therefore be entrusted with this responsibility.

Conserving wetlands, while at the same time maintaining the agricultural resource base in Kisii district by practicing environmentally compatible farming, is a necessity. For this to be realized, it is important that conservation policy makers and agricultural officers should have sufficient information on farmers awareness of environmental issues, improve it if possible and make farmers in the district the key focus of a future wetland conservation programme.

Although wetlands have been widely studied in Kenya recently, quantitative analysis of the effect of agriculture on wetlands in the district is limited. Moreover, research on the relationship between farmers and wetlands is non-existent in Kisii district.

Wetlands commonly occur in human-dominated landscapes [11, 21]. Studies have shown that negative effects on wetland species and ecosystems functioning are due to human activities [10]. Farmers who own vulnerable ecosystems have a strong utilitarian attitude to the environment [31, 32]. Knowledge of the relationship between farming practices and wetland conservation is central to the development of sustainable farming and the formulation and implementation of effective management measures to conserve wetland resources in Kisii district.

The present study examined farmers' knowledge on the effect of agriculture practiced on wetlands in Kisii district; the attitude of farmers with respect to planning mechanisms that might be used to support wetland protection in the area and the need to build a conservation ethic among wetland farmers.

Review of literature

The most commonly known wetlands are open coasts, flood plains, fresh water swamps, lakes, peat lands and swamp forests. Each one of these has a wide range of different wetland types. Irrespective of their types, sizes or locations, however, wetlands are of great and matchless ecological and socio-economic value. This is, for instance, true in the case of the valley bottom freshwater marshes which are central to this study. Wetlands play a key role in pollution assimilation and flood control, serve as breeding and nursery grounds for many species of fish and wildlife, and help maintain ground water supplies and water quality [8, 16, 24]. Africa has over 520 000 square kilometres of large standing water bodies and the possibility of sustainable development is vast, providing a reliable and profitable asset. So accurate delineation of wetlands where they occur is of great importance [13].

Wetlands commonly occur in human-dominated landscapes such as agricultural and urban regions [11, 21]. Studies have shown that negative effect on wetland species and ecosystem functioning can be expected in such areas due to human activities [1, 10, 11, 17, 18, 20]. A strong 'utilitarian' attitude to the environment has been found among farmers owning vulnerable ecosystems compared to other populations [31, 32]. Thus,

assessment of the ecological status of wetlands in human-dominated landscapes is critical for their effective management and protection.

The values of wetlands are well documented [15], but the implications of their cumulative losses on national, regional and continental scales are not clearly understood. The following review indicates the kinds of impacts that could occur if we lose our wetland ecosystems. Wetlands are home to many plants and animals due to their temporal and spatial variability. They are rich in endemic, rare and endangered species. For example, more than half of Europe's most endangered birds depend on wetlands [6]. In Belgium, 97% of the 306 plants classified as rare, vulnerable, endangered or already extinct are wetland species. Such information is missing in our country and this study comes up with such statistics of the study area to help emphasize the need for conservation of wetlands.

One of the main ways in which mankind has been using the valley bottom wetland or fresh water marsh is cultivation. The importance of such wetlands in this regard lies mainly in their remarkably higher productivity compared to most upslope areas. In fact, as empirical findings indicate, some wetlands can produce eight times as much plant matter as an average wheat field. The cultivation of wetlands, which as a rule calls for some degree of drainage, however, can lead to their rapid degradation and loss of perennial supply of water unless it is done wisely. One of the well known consequences of the unwise cultivation of wetlands is not only the loss of the wetlands themselves but also the fast decline in the fertility of the soils. Wetland soils are formed under special chemical conditions of a waterlogged environment and tend to turn acidic under drained conditions. Thus, it is quite common for drained or severely degraded wetlands to become unsuitable for crop production or even for grazing. Drainage and other forms of disturbance associated with agriculture are widely identified as the main contributor to wetland loss. Williams [33] has suggested that globally, 160 600 km² of wetlands had been drained by 1995, primarily for agriculture and food production. For instance, it has been estimated that about 90% of New Zealand's former wetlands have been absorbed by arable, pastoral and horticultural developments [22]. Wetlands are important elements in the global cycles of nitrogen and sulphur [9]. Inevitably therefore, the continuing loss of wetlands through drainage must have significant impacts which repercussions at present are not clearly understood.

Research on the relationships between farmers and wetlands is nearly non-existent in Kenya and rather limited internationally [32]. Similarly, quantitative analysis of the impact of agriculture on wetlands is limited [5] due to insufficient environmental monitoring.

Increased awareness about the adverse environmental and socio-economic consequences of the unwise exploitation of wetlands has resulted in worldwide calls for the sustainable management of fragile resources. However, the sustainable use of wetland resources has increasingly proven to be an extremely difficult and frustrating task in many developing countries. A substantial amount of literature that has appeared on this issue tends to carry the undertone that poverty is one of the major factors that make it very difficult to achieve the sustainable use of wetlands. Some writers boldly point out that the modern notions of natural resource conservation are simply at odds with the survival strategies of the poor of the Third World that are dependent on wetland resources.

There has been a growth of interest in wetlands and an accompanying change of attitude [33]. In some countries, rates of loss are now slowing [14]. At international

level, the protection of wetlands is clearly reflected in the Ramsar convention. This convention plays an important role in facilitating the protection of wetlands of international significance. However, the full protection of the remaining wetlands in Kenya and in all other countries can only be achieved through implementation of management strategies at national or sub-national levels. This conclusion follows simply because most of the remnant wetlands do not qualify under the terms of the Ramsar convention, which is aimed at protecting wetlands of international significance.

Most authors contend that poverty contributes to wetland degradation in two closely related ways. First, they point out the fact that an intense competition exists between different categories of wetland users whose livelihood rests largely on their access to these resources. The lack of other means of survival makes the competition between them so uncompromising that they fail to reach a consensus on the sustainable exploitation of wetland resources. This, they say, is true in the case of the conflicts that often arise between upstream farmers who want more flooding, downstream farmers who want less, fishermen who are interested in early flooding and herdsmen who want greater access to wetland grazing. Secondly, they argue that the people who tend to exploit wetland resources in developing countries are in such a desperate economical situation that they cannot afford to use such resources judiciously. The main argument here is that since the poor „live within biomass-based subsistence economy”; their interests for short-time gains by far outweigh their willingness to treat wetlands caringly in anticipation of the long-term returns.

Although the literature tends to portray the poor as the primary users and abusers of wetlands in developing countries, there are sufficient indications that the poor may not always have access to these resources. For instance, some communities are known to have traditional resource management arrangements that regulate the ways in which and the extent to which wetlands could be exploited. Wetlands could either remain in near pristine conditions or the people may use them in an appreciably sustainable way where such resource management arrangements are strong enough to check their destructive exploitation by economically desperate and uncaring individuals. This is not to say that exploitation of wetlands by wealthier members of a community is necessarily sustainable. This simply means that such regulatory controls could significantly lessen the devastating pressures to which a substantially large and predominantly poor community could subject these fragile resources if they were open to unlimited access. To some extent, this appears to be true in the case of the wetlands of Kisii District of Western Kenya, which are presently being threatened by expansions of settlement and cultivation, brick making, urbanization and so forth.

Wetland losses are not easily reversible thus protection and conservation of the remaining ones is of paramount importance. There has been some progress toward protection of wetlands, but the pace has been slow. In the 1960's, the International Biological Programme (IBP) initiated project AQUA and the IUCN began project MAR. These were designed to increase protection of wetlands and to increase awareness of the importance of wetland and peatland ecosystems and the threats to which they were exposed [15]. In 1975 the Ramsar convention came into force and it was one of the world's first international conservation treaties with 45 signatory states, of which Kenya is one of them. Reports in 1987 suggested that the convention was short of funds, was breached by some of the signatories and did not include some crucial nations [25]. In practise, signatories also apparently tend to ignore the terms to which they are signatory a case the proposed study hopes to look into. There is also lack of an

adequate database on wetlands. With inadequate information on extent, structure and function of our wetlands effective management is severely hindered. Despite much effort by IUCN to establish a database on wetlands [27] databases covering areas such as Kisii District are missing.

Concepts of the study

The population-environment debate during the 1980s incorporated a new dimension, the concept of sustainable development (WCED, 1987). The most important component of sustainable development is the protection of the environment. The carrying capacity of the earth is already under stress because of the expansion of human population.

According to Andrew [2], settlement pressure, wetland reclamation and destruction of forests combined with high rates of population growth and rapidly dwindling reserves of land for development of new agricultural areas, are all typical problems that face many developing countries.

Fog & Lampio [12] observed, „few of the world’s major habitat type have suffered as drastically from man’s abuses of the environment as wetlands”. As evidence of this abuse, a recent report suggests that wetlands have been disappearing at a rate of about 1050 square kilometers per year in Kenya. At this rate wetlands have become one of Kenya’s rarest ecosystems.

As Burns stated: „Individually, the loss or modification of small wetlands or corners of large wetlands may not seem important to developers keen to meet the challenge of bringing more land into use for agriculture, horticulture, housing or roads. The effects of these losses and modifications are cumulative and insidious, however.” According to Williams [33] and Ehrenfeld & Schneider [11] drainage and other disturbances associated with agriculture are the main contributors to wetland loss and modification.

Study area

With a view to develop the knowledge of wetland users in Kenya about wetlands and their use, a survey of rural landholders in one district was carried out. Because the questionnaire addressed issues relating to planning mechanisms and approaches, the decision was taken to interview landholders within a single, and in this case a whole district planning unit. The aim was to standardize the survey in terms of the institutional context. The area that was eventually chosen was Kisii District, which is found in Nyanza Province, Kenya (*Fig. 1*)

This area lies between 0°30’–0°58’S and 34°42’–35°05’E. It occupies an area of 645 km² land and it is subdivided into five administrative divisions.

The district is predominantly rural and agricultural. About 77% of the land is sustainable for agriculture. The once abundant wetlands in the district now there are only remnants left. The extensive draining of wetlands for agricultural and settlement purposes accounts for most of the losses. The remnants contribute to the natural heritage of the district.

Materials and methods

Data were collected in 2004 by interviewing 100 farmers from Keumbu division, 45 from Marani division, 50 from Suneka, 45 from Masaba division and 50 from Mosocho division.

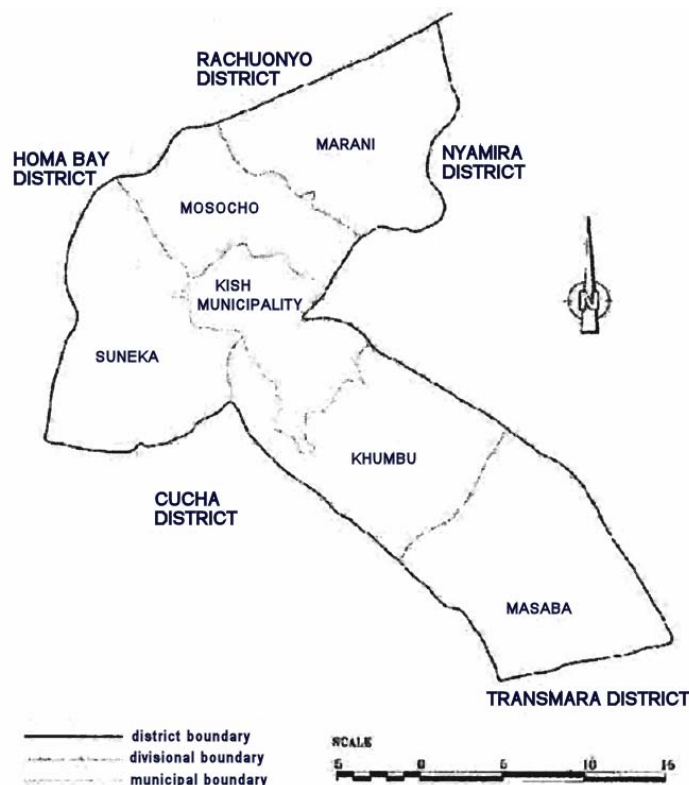


Figure 1. Map of Kisii District

Information was collected on various demographic groups of farmers and their immediate family, characteristics of the farming practices, attitudes towards the wetlands, farming and the environment, knowledge of the effect of agriculture on the local wetlands. Environmental questions were dealt focused on local rural environment of the respondents.

A 9-grade scale was used to assess the level of knowledge respondents had about the environmental effect of agriculture. Each farmer was asked to say whether agriculture may impact on the local environment (water, soil, climatic conditions, wildlife and landscape beauty) and whether several farming practices such as application of chemical fertilizers, pesticides, land consolidation and drainage have any consequences on the environment. The knowledge score was computed by summing the response scores of the component items, using the following integral values: correct – 3, do not know – 2, and wrong – 1.

Correlation analysis was used to evaluate the ability of the individual questions to ascertain the attribute measured by the total scale (Likert scale). A high Cronbach coefficient (alpha) of 0.810 resulted indicating high validity of the test. Three items with low correlation coefficients were dropped from the analysis. Responses on the remaining eight items were subjected to factor analysis.

Statistical analysis was carried out with the help of SPSS (Statistical Package for the Social Sciences). Student's t-test for unpaired samples and one-way analysis of variance was used. The median value of knowledge on the environmental effect of agriculture, was used to the five samples into two groups: farmers who scored below the median (ignorant) and those who scored above the median (conscious).

Results

Characteristics of the landholdings

The landholdings in the district ranged from 0.5 to 1.5 hectares. The respondents owned almost all of the land. Each farmer owned about 12 hectares of the wetland. Wetlands occupied 5% of the landholdings. Approximately 400 hectares (7%) of the land were covered by wetlands.

Farming was the primary land use and 80% of the respondents practised dairying and goat farming, 60% obtained all of their household income from land and 10% obtained more than 90% of their total income from farming. Only 5% of the farmers were found in the rural areas of the district

The average age of farmers was 40.5 years. They all had farming experience of 20 years and over two-thirds had more than 10 years of schooling. All the respondents said although they were cultivating wetlands farming was not a profitable business. Agriculture largely depends on family labour. Livestock such as cows and goats kept and grazed in the wetlands were reported to be bigger than those grazed elsewhere.

Wetlands values in Kisii District

More than 60% of the respondents rated environmental issues as being important or very important (1 or 2 on a 4-point Likert scale)

In a question that went more directly to the subject of wetlands, the landowners were asked to rate (on a 4-point scale) several sources of value that might be recognized in wetlands (*Fig. 2*). The four values considered by the greatest number of respondents to be very important were the role of wetlands in maintaining water quality (rated as important by 90% of respondent). And as a habitat for species of socio-economic and cultural significance, 91% of the respondents recognized wetlands as offering habitat.

A chi-square contingency test revealed statistical relationships between several landholding and wetland values by the sample group. The proportion of income obtained from the landholding shows the value placed on wetlands as an area for grazing stock or brick making. For example of landowners obtaining 95% or more of their income from the landholding, 74% considered it to be important, while 33% landowners who earned less than 95% of their income from the landholdings considered it to be important. The proportion of income and the scenic value of wetlands were also important e.g. those earning less than 95% of their income from the landholdings, 87% considered the scenic value of importance, while only 50% of those earning 95% or more reported that it was important.

The proportion of income earned from the farm was linked to attitudes towards the importance and use of wetlands in Kisii district. These findings are consistent with other studies that established the relationships between affluence and the level of dependence upon the land, conservation attitude and behavior.

It was anticipated that the uses of wetlands for recreation contribute to positive attitude towards wetlands. In this study investigation of attitudes towards wetlands, recreation by the local community was defined to include hunting, bird watching, walking, fishing and any other leisure activity. Landowners (70%) in Kisii district who carried out recreational activities in wetlands considered them to be important for grazing. Of those landowners that did not use their wetland areas for recreation only 44% suggested that grazing was a valuable wetland activity. This result shows that landowners using the wetlands for recreational activities hold a more utilitarian view.

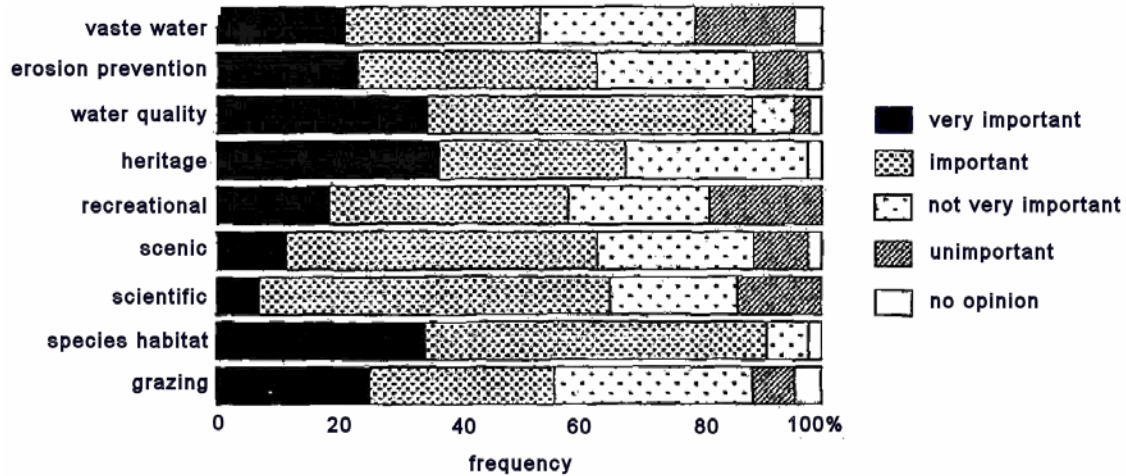


Figure 2. The values assigned to wetlands by landowners in Kisii District

The drainage of wetlands represents one of the most significant and widespread threats to their effective preservation. Amongst the landowners surveyed in Kisii district, drainage of wetlands on the landholding had been carried out by 70% of the landowners. Drainage had been carried out for reasons relating to access, planting of exotic trees species, and reducing loss of stock, increased pasture and productivity, and the “conversion of wasteland”. Of those landowners that had carried out drainage, only two had sought consent, as they are required to do by the Kisii district municipal council. In fact, the general awareness of the consent process was very low, only 31% of the respondents knew that consent was required for drainage works or other modification to wetlands. Another 60% affirmed that consent was not necessary, and 10% admitted they did not know whether it was necessary or not.

Levels of environmental awareness

The level of awareness of the environmental effect of agriculture measured by the scale of ‘knowledge’ was lowest among farmers in the wetlands, followed by farmers away from the wetland areas (Table 1).

Investigating particular aspects of ignorance it was found that among 8 aspects presented, farmers in wetlands scored higher in six of them, while farmers not occupying wetlands scored higher in three providing a piece of evidence of the higher levels of ignorance among wetland farmers. Five of these differences (water quality, soil quality, wildlife, pesticide and chemical fertilizers) were statistically significant, indicating the magnitude of ignorance on the part of wetland farmers (Table 2).

Farmers occupying areas away from wetlands and scored higher on the knowledge scale were younger, less experienced in farming, had more formal education, practiced part-time farming, derived less income from farming and had more income from off-farm activities. Further it was discovered that farmers with mixed farms had significantly less knowledge about environmental effect of high input agriculture than crop farms.

Conclusions and recommendations

The analysis has revealed that a large number of farmers in the wetland areas do not take the environmental effect of agriculture into account. Ignorance by farmers of wetland values and functions and of the magnitude of their effect on wetlands becomes

Table 1: Level of knowledge of the environmental effect of agriculture among farmers of Kisii District based on Likert scale. N represents the values of responses

scale	farmers in the wetlands (N = 100)	farmers away from the wetlands (N = 140)
agriculture and environment	20.4±0.4	22.9±0.3
chemical usage	8.2±0.1	8.9±0.1

Table 2.: Ignorance by farmers on the effect of farming activities in the wetlands of Kisii District based on Likert Scale

	farmers in wetlands	farmers away from wetlands
chemical fertilizers (%)	45.5±0.08	34.2±0.04
pesticide application (%)	22.7±0.03	16.6±0.03
land consolidation (%)	96.6±0.01	96.2±0.01
drainage (%)	82.6±0.06	90.1±0.03
water quality (%)	65.9±0.04	43.7±0.04
soil quality (%)	53.0±0.04	54.0±0.04
wildlife (%)	68.4±0.07	32.0±0.04
landscape (%)	78.6±0.05	44.8±0.04

a major contributor to their degradation. Wetland farmers practiced a more intensive form of agriculture and were rated higher in their level of ignorance concerning the environmental effect of agriculture than farmers away from wetlands.

Both aspects (intensity of agriculture and ignorance) have to be seriously considered in any management plan to conserve the vulnerable resources of wetlands.

Farmers in wetlands have stronger utilitarian attitudes toward wetland resources than their counterparts away from wetland areas. Therefore, more effort should be placed in changing patterns of agricultural practices to a more sustainable manner. The revival of sustainable farming practices of the past, through policy measures securing income and providing proper training, would be more effective for the long-term viability of wetlands.

The knowledge gap concerning the environmental effect of modern agriculture among wetland farmers, along with the effect of training programmes, calls for immediate action to implement education / training programmes specifically designed to address the educational needs of wetland farmers in Kisii District. Providing farmers with relevant information and education regarding the environmental effects of agriculture and the effects of their practices upon the environment and resources must be placed higher in the conservation agenda. Farmers attending these training courses would be expected to become more environmentally knowledgeable and eventually change their behaviour in a responsible way. The role of public administration must also change from that of an implementing agency for specific conservation programmes to that of a facilitator, promoting, encouraging, guiding and making possible larger participation of rural people in developing and applying more sustainable forms of land use. Finally, development of off-farm employment opportunities, like eco-tourism and the introduction of permanent payments linked to agricultural practices that are compatible with the extensification of the production process (e.g. conversion to organic farming) are among the measures that can bring more sustainable use of agricultural resources in these wetlands.

The overall outcome of this study is the need to build a conservation ethic among farmers, particularly in environmentally sensitive areas. This can only be achieved by:

1. educating farmers on the significance of conserving natural resources – especially those living in wetlands;
2. training them to practise sustainable forms of agriculture;
3. rewarding the most environmentally friendly agriculture.

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