Rapport

Forsvarsbygg

Environmental Impact Analysis Iron Sword 2005

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Summary

Norwegian Defence Estates Agency (NDEA), Department of Environment and Cultural heritage (MIKU) has, on the behalf of National Joint Headquarters (NJHQ), performed the environmental impact analysis as a part of the preparations for the exercise Iron Sword 2005. The exercise affects 10 municipalities in Hedmark County.

Information related to protected areas, vulnerable elements of biodiversity, important areas for outdoor life, registered cultural heritage, pollution, noise, waste handling, noise sensitive agriculture, aquaculture and vulnerable infrastructure are collected from civil authorities. A total of 2009 localities containing environmental information have been digitalized and included in exercise maps (scale 1:50 000). The digital datasets are handed over to NJHQ to be used in GIS software. The environmental information used in the impact analysis has been received from civil environmental authorities. The registration of such information in Norway is not complete, and due to this the analysis is not fully able to give a complete picture of vulnerable localities in the exercise area.

Exercise Iron Sword 2005 is carried out during summer, which probably is the time of year with highest risk to encounter environmental challenges. A risk analysis has been performed to identify activities highly probable of causing serious environmental harm. In this analysis environmental aspects are weighted more than economical interests.

Waste handling is superficially discussed in the impact analysis, but more detailed information of this theme will be described in a separate waste plan. Distinct preventive actions regarding challenges are recommended. Additionally, more general efforts are recommended for the periods before, during and after the exercise.

A list of persons in civil authorities contacted during sampling of information is included. Map sheets and attribute tables containing mapped environmental information are also attached (scale 1:120 000). These maps correspond to the exercise maps (scale 1:50 000) mentioned above.

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1 Introduction

According to Chief of Norwegian Defences guidelines for military exercises and STANAG 7141 an environmental impact analysis is to be performed prior to larger military exercises. Consequently, in later years such analyses have routinely been performed prior to such exercises involving both foreign and Norwegian forces. The most recent environmental impact analysis was carried out in front of Battle Griffin 05, an exercise which took place in 24 municipalities in the two counties Nord-Trøndelag and Sør-Trøndelag in Norway.

The exercise Iron Sword will be arranged in Hedmark County, Norway in spring/early summer 2005. The National Joint Headquarters (NJHQ) assigned the Norwegian Defence Estates Agency (NDEA) the task to carry out the impact analysis of this exercise. Also contributing to the analysis is Norwegian Military Geographic Service (FMGT), which is responsible for cartographic preparation and the printing of exercise maps.

An environmental impact analysis is a guiding tool aiming to minimize the negative impacts on the environment during an exercise. A major perspective is to present information and guidelines in a way that contributes that to Iron Sword 2005 being performed according to Norwegian law and The Ministry of Defence's own political goals presented in The Ministry of Defence environmental action plan (2002). The analysis consists of three main parts. Firstly, environmental information is presented in a geographic information system (GIS) including both analogous and digital maps and corresponding attribute tables. Suggested restrictions on the military activities to reduce negative environmental effects are shown on the maps. Secondly, a risk analysis considering how different military activities may influence different environmental aspects is presented. Lastly, more general advice is given on how to minimize negative effects of specific activities.

By using paper/digital maps and attribute tables combined, the users of the environmental impact analysis will gain information of both environmental values in the exercise area and proposed restrictions on military activities to minimize negative environmental effects on such values. The risk analysis evaluates both the consequences of performing the different activities and the probability that such consequences will appear given the specific exercise pattern of Iron Sword 2005.

GIS used prior to and during exercises is a rather new tool in environmental planning of military activities. GIS improves the availability of large amounts of localized environmental information making it possible to both standardise and increase the efficiency of data sampling in front of the exercise, effectuate more complicated analysis and improve data assess control during the exercise. However, to be able to fully utilize the potential of GIS it is vital that personnel in central positions during exercise planning are sufficiently trained with GIS and has available necessary hard- and software together with prepared environmental information.

In the environmental impact analysis of Iron Sword environmental aspects are weighted more than economical interests. Environmental information has been collected from civil authorities. The registration of such information in Norway is not complete, and therefore, the information of the impact analysis can not be considered to give a complete overview of vulnerable environmental localities in the area of the exercise.

2 Material and methods

2.1 Exercise area

The exercise Iron Sword 2005 will be performed in large parts of the Hedmark County during spring 2005. NJHQ has defined the exercise area and have agreed that environmental information should be gathered within the following 11 map sheets: 1916-1, 1916-2, 1916-4, 1917-2, 1917-3, 2016-1, 2016-2, 2016-3, 2016-4, 2017-2, 2017-3 (figure 1).

In the exercise area the winters are dry and cold with a stable snow cover while the summers are dry and warm. The average annual precipitation is about 500 mm. The exercise area includes a variation of landscapes and nature types. Boreal forests influenced by forestry dominates the landscape mixed with a high proportion of bogs and watercourses, lakes and rivers.

The settlement pattern within the exercise area includes small towns and villages of varying sizes. Primary industries are important businesses in the area, and therefore large areas are dominated by fields used for grain production together with field of potato and other types of vegetables. The area between lake Mjøsa and the Swedish border is characterized by diverse settlements, with a large number of traditional farmer buildings, many of them concentrated near roads and old communication systems. A large part of the existing roads follows or are built on top of older communication systems. Traces of preindustrial farming is still visible in the cultural landscape. Outlying fields are wide and wild with a wide range of spread remains of cultural heritage connected to hunting and fishing from old times up to today. This area have also a considerable representation of archaeological findings from the following pre historical periods: stone age, bronze age, Iron age, Viking age, and the medieval period. The archaeological findings are found near the lakes and rivers, in the forests and in the agricultural areas. The findings consists of stone age implements, dwelling sites, trapping systems, burial mounds, iron production sites.

2.2 Activities and extent of the exercise Iron Sword 2005

In exercise Iron Sword 2005 ten nations will participate: the Netherlands, England, Italy, Greece, Germany, Denmark, France, Spain, Turkey and Norway. A total of 4-5000 soldiers and about 1500 vehicles, included 125 armoured combat vehicles, will participate. The duration of exercise is from the 23rd of May to the 20th of June. The main section of activities will take place in densely build-up areas and along roads. Activities involving personnel and vehicles in outdoors fields will therefore take place to a lesser degree.

In comprehension with the employer NJHQ, the environmental impact analysis main objective is to evaluate activities which may come in conflict with environmental aspects on the basis of this specific pattern of activity in Iron Sword 2005. The current activities is evaluated in the risk analysis below (chapter 3).

2.3 Environmental aspects regarding exercise Iron Sword 2005

Given below are descriptions of different environmental aspects. The aspects are viewed in regard to the specific exercise area and the period of time in which the exercise is carried out.

2.3.1 Biodiversity

Potentially, several military activities performed in exercises like Iron Sword 2005, can result in serious and irreversible consequences for biodiversity. Main challenges are to ensure that such activities do not lead to loss, degradation or fragmentation of important habitats nor serious stress on wild life species.

The exercise area is dominated by boreal forest with a large proportion of bogs. The area also includes several water system and lakes. Bogs and other moist areas are the most vulnerable nature types to military activities. The exercise is carried through at a time of year with no ground frost, and this amplifies the risk of such damage. Changes in surface structure may cause draining and long lasting negative effects for biodiversity. In addition, many wildlife species have their breeding season in this period. This makes them especially vulnerable to disturbance. Such species have breeding habitats in forests (e.g. bird of prey, capercaillie and ungulates), bogs (e.g. wading birds and black grouse) and water systems (e.g. ducks and beaver). Regarding biodiversity, it is also very important to prevent pollution of water systems and lakes. Pollution even by relatively small quantities of oil and fuels may lead to serious harm on fresh water ecosystems.

Spreading of alien species is viewed as one main threat to biodiversity. Both the spread of species across national boundaries and spread of species between different regions/ecosystems in the same country are potential threats. Regarding the threat of species introductions across boundaries, the participation of foreign forces at the exercise may constitute a threat of spreading alien species. The many water systems are rather segregated ecosystems within relatively small distances. This makes them especially vulnerable for species invasions even if military activities are ranging over relatively small distances.

2.3.2 Outdoor life

Several military activities performed in exercises like Iron Sword 2005 may potentially have negative consequences for outdoor life. Preventing permanent physical damage to much used outdoor areas, tracks and nature areas of high aesthetic value is a main challenge. Such damages are at greatest risk in different motorised driving activities, and therefore it is essential to have good routines and control regarding this. The exercise is carried through at a time of year with no ground frost, and this amplifies the risk of such damage. At the same time the immediate quality of outdoor activities can be affected and military use of important outdoor areas must be reduced to a minimum during the exercise. In this time of year, many people go fishing in lakes and rivers in the exercise area. Many areas are also used for hiking, and for nature experience. Therefore, planning military activities must also include routines securing that special considerations in important outdoor areas are taken.

2.3.3 Cultural heritage

Some of the activities performed in Iron Sword 2005 potentially can result in permanent physical damage to cultural heritage or their surroundings. This includes damages to archaeological findings[1], traces in the ground (non-registered) and more recent cultural heritage and the surrounding cultural landscape. A large part of existing roads follows or are built on top of older communication systems. Old settlement, villages, farms and other buildings are often closely connected to these roads. Damages therefore may occur also by driving on existing roads as well as in cultivated and outlying fields, especially in early summer periods. Damages may also occur during bivouacking, amphibious operations, and temporary building of firing positions and similar. Areas that are especially vulnerable are outlying fields not covered with snow, old paths, roads and bridges and inland lake shores. Old roads and more recent cultural landscapes

[1] Grounds, buildings and installations prior to 1537 and standing buildings from the period 1537-1649 are automatically protected due to the Cultural Heritage Act, § 4

(after 1537)including heritage buildings and installation are not fully registered and marked in Norway. Unlike the situation in the southern part of Europe, archaeological findings in Norway are very often not visible above the ground. Such findings are vulnerable to activities like driving in outlying fields, driving on cultivated land and bivouacking. It is important that the activities are planned aiming to minimize the risk of damage on such environments and unregistered archaeological cultural monuments. It is important to have good routines and control when the activities are performed.

2.3.4 Pollution

Large quantities of fuel, oils, chemicals and ammunition are used during military exercises, and if not handled carefully, spills can occur and harm nature and humans. It is especially important to locate fuel distribution to areas where spills quickly can be controlled and where spreading easily can be prevented. Potential routes of spreading (for example drain pipes) have to be surveyed in advance. Fuel distribution areas should be located to areas where spills cannot lead to severe consequences, thus far away from rivers, drinking water supplies and drainage ditches or -wells. The consequences of diesel or oil spills from for example accidents involving vehicles are especially high near watercourses, drinking water supplies, on cultivated land, and important nature areas. This exercise takes place in an area where many communities rely on water supply from wells dug near rivers, and therefore sensible to water pollution in rivers and lakes regardless of size. Lake Mjøsa and several major rivers do serve as a source for drinking water, but have not been marked as restricted or prohibited areas as similar civilian activities are allowed.

In smaller watercourses even minor incidents may cause severe harm. Equipment to collect spills and to prevent spreading must be in place. Units must be aware of their responsibilities, and routines for notification of spills and procedures for emergency must be established in advance. Hazardous chemicals are dangerous even in small amounts. Routines for handling must be established to prevent accidents.

2.3.5 Noise pollution

Military noise sources can be characterised as largely diversified. When military noise is present in areas which are usually not used for military activity, it may be experienced as more negative than in areas where this kind of noise is normal (training fields, airports etc). Iron Sword 2005 is carried out in a period of the year when people spend much time outdoors after working hours and in weekends. Therefore, military activities in afternoons and weekends close to built-up areas can be more disturbing than at daytime. Additionally, longer periods of shooting and military driving activities near houses at night can for some people be annoying and should be minimized. To minimise negative consequences of noise, special care must be taken in areas that can be sensible to noise, for instance agricultural areas and various public buildings. Additionally, the effects on vulnerable wild life must be considered in relation to their survival, growth and reproduction. Knowledge of such problems is best documented for large mammals as reindeer, moose, deer and roe-deer, but similar negative effects probably also concerns other animal groups.

2.3.6 Waste

The Ministry of Defence focuses on waste handling in its environmental action plan *"Forsvarets miljøvernarbeid* (2002)" by defining goals to improve handling and prevent pollution. Good routines are necessary to prevent pollution in soil, air and water, and make sure that waste does not reduce the value of outdoor activities. Waste handling must be adjusted in a way that do not reduce the quality of the exercise or intervene with military tactical issues. It should be carried out efficiently by all military services in alternating terrain and different nature environments.

To be able to have efficient and proper waste handling, a waste handling plan including a map showing local waste disposal stations must be established. All the containers must also be correctly marked with symbols. A contract with renovator must also be prepared prior to the exercise.

2.3.7 Vulnerable constructions and institutions

Military presence may in special situations seem scary and be problematic for example near asylum reception centres and kindergartens. The same may apply regarding churches, chapels, cemeteries etc. Additionally, sensitive installations like research areas and water intake for aquaculture must be considered. Routines which include special consideration for such sensitive elements, must be established during both the planning and executing phase of the exercise.

2.3.8 Other challenges

In addition to the environmental challenges facing Iron Sword 2005, economical issues must be considered when possible. In the exercise area such values include reforested areas, cultivated land and aquaculture. Especially minor roads with fragile fundaments may easily be damaged in early summer season very short after the ground frost thaw.

As for the risk of spreading alien species mentioned above, it is also very important to prevent the spread of agricultural and freshwater diseases, like the potato cyst nematode (potato root eelworm) and water mold on crayfish. Care must be taken both regarding such spread from foreign countries and between different areas within Norway.

The exercise is carried out in the time when farm animals are let out to grazing lands. Extensive military activity causing load noise should be avoided in areas close to grazing farm animals.

Even though human security is not a primary issue in the environmental impact analysis, a reminder regarding this is in place. In exercises like Iron Sword 2005 taking place in or near densely populated areas, it is very important in every part of the exercise to have a strong focus on the security of inhabitants.

The exercise area contains one of the densest populated moose areas in Norway. Groups of moose may some time be located close to main roads, and military activity in such areas may cause animals to cross roads. This may lead to very dangerous situations, and precaution should be taken in activities carried out close to the most heavy trafficked roads in the exercise area (E6, Rv3 and Rv25).

2.4 Data sampling

Data acquisition has been carried out in the following10 municipalities in Hedmark County: Stange, Åsnes, Åmot, Elverum, Stor-Elvdal, Løten, Våler, Ringsaker, Hamar and Trysil. Information has been received from the municipalities, Directorate of Nature Management, Directorate of Fisheries, the County Authorities and County Governor of Hedmark. A list over people contacted in the different authorities is shown in appendix 1.

Environmental information has been gathered for each of the 11 map sheet. In agreement with NJHQ and FMGT it is in the currency grid of the exercise area, left out some areas inside the map sheets. An overview of where data gathering have been done, is shown below (figure 1).

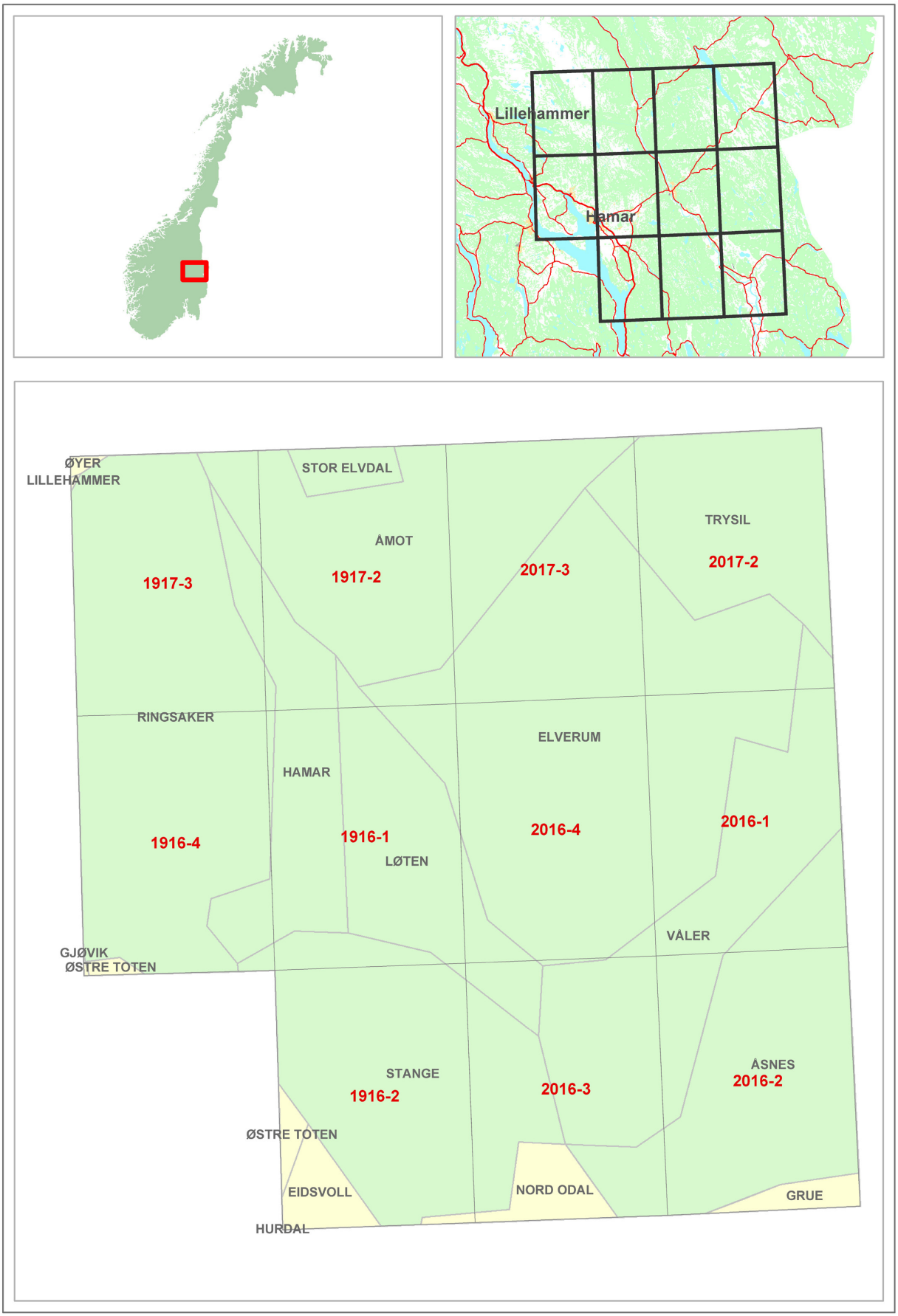

Figure 1. An overview of where data gathering have been done, Iron Sword 2005. Mapped areas illustrated with green colour. Not investigated areas are illustrated with yellow colour.

Data gathering was conducted asking the information sources to report environmental information after a template worked out by MIKU. The template is based on sample procedures from previous, similar military exercises, as requested by NJHQ. The following topics were included in the template: protected areas, vulnerable elements of biodiversity, important areas for outdoor life, registered cultural monuments, pollution, noise, waste handling, noise sensitive agriculture, aquaculture, vulnerable infrastructure etc. Information which was possible to locate, is drawn on theme maps produced by MIKU.

2.5 GIS

A geographical information system (GIS) consists of different elements: software, computers, digitalized information, derived products like paper maps, digital maps and attribute tables, and the personnel using the gathered and derived information. The environmental impact analysis of Iron Sword produces both digital maps which are joined to attribute tables, and environmental paper maps.

2.5.1 Digital maps

The digital data consist of 3 shape files (*polygons*, *points* and *additional_data*) to be used in GIS-products (ESRI). The data set has been digitalized in WGS84 UTM zone 32, and may be converted for use in other applications as SOSI-format. The themes *polygons* and *points* are the base for producing exercise maps on paper. The theme *additional_data* contains other practical environmental information printed on maps in appendix 3. Explanations of attribute tables which are linked to objects on maps, are described below (appendix 2). The digital data set is delivered NJHQ to be used in the exercise and to FMGT for the management of the data set.

2.5.2 Paper maps

FMGT has, based on gathered and adjusted information from MIKU, been responsible for the production and distribution of paper exercise maps (scale 1: 50 000).

Additionally, during the impact analysis there are produced overview map sheets showing important environmental elements in the exercise area (scale 1: 130 000) where each element is given an individual number (appendix 3). Information about this locality number can be found in the paper version of the attribute table (appendix 5). This makes it possible to combine maps and tables to gain information on single map elements.

On both types of maps suggested restrictions on the military activities to reduce negative environmental effects are shown (table 1).

2.5.3 Use of GIS

To fully utilize the potential of the GIS, certain criteria must be fulfilled. To efficiently make use of the sampled environmental information, it is vital that selected personnel in central positions during exercise planning are sufficiently trained with GIS and also has available the necessary hard- and software together with prepared environmental information. In military exercises like Iron Sword this must be present in the coordinating environmental point of the exercise - The environmental cell. Therefore, it is recommended that at least one person in the environmental cell at any time during the exercise is sufficiently trained in GIS, and that at least one computer with necessary software and environmental information is present in the cell.

It is also recommended that all environmental officers at any time have available the environmental maps in environmental impact analysis (appendix 3) together with the

corresponding attribute tables (appendix 5). Combined use of both maps and tables gives background information of each marked locality on the maps.

2.6 Map symbols

In agreement with NJHQ several changes in the layout of the exercise maps have been carried out as a pilot project in front of exercise Iron Sword 2005. The main objective has been to simplify the map symbolization and types of restrictions given. The changes have resulted in a reduction from 18 to four restriction classes. Classes of similar type have been grouped, and information of non-environmental character have been excluded bringing the environmental aspects into focus (table 1). Reducing the number of restriction classes also implicates less detailed environmental information printed on maps. If needed, the corresponding attribute table (appendix 5) might be utilized to gain more detailed information on single map objects. Vulnerable objects are delimited in accordance to existing guidelines for military activity in Norway.

Table 1. Environmental restrictions printed on exercise maps, Iron Sword 2005

Prohibited areas		**All military activity prohibited** Passing through on public roads allowed, all hostile activities prohibited	Protected areas Drinking water Areas damaged by military activity Research sites
		**All military activity prohibited, buffer zone 300m** Passing through on public roads allowed, all hostile activities prohibited	Protected areas Drinking water Agriculture vulnerable to noise Institutions vulnerable to military activity
Restricted areas		**Organised military bivouacking and fuel distribution prohibited. Use of vehicles off road are only allowed in the period 01.11 - 31.03 providing sufficient snow and ground frost conditions** Passing through on public roads allowed	Biodiversity Cultural heritage Outdoor life Catchments areas
		**Organised military bivouacking, fuel distribution and use of military vehicles prohibited, buffer zone 300m** Passing through on public roads allowed	Biodiversity Cultural heritage Outdoor life Aquaculture

3 Discussion

3.1 Data sampling

Of total 10 municipalities, 9 reported information according to the enquiry from NDEA. One municipality (Trysil) did not report results due to low working capacity. All regional information sources reported according to the enquiry from NDEA.

A total of 2009 localities (1195 polygons and 814 points) were, based on reported information, digitized and recognized as relevant environmental information. Table 2 illustrates the distribution of information according to the categories on exercise maps.

Table 2. Count and categorical distribution of localities, Iron Sword 2005.

Category	Count	Category	Count
Protected areas	36	Cultural heritage	861
Drinking Water sources	99	Outdoor life	11
Areas damaged by military activity	0	Aquaculture	20
Research sites	8	Parking areas	8
Agriculture vulnerable to noise	82	Civil shooting ranges	14
Institutions vulnerable to military activity	166	Suitable waste handling areas	5
Important areas for biodiversity	696	Suitable fuel distribution areas	1

3.2 Data quality

Geographical precision of data, time for update of data and type of information available have differed significantly between the information sources. Variation of both amount and size of objects within the exercise area may partly be a result of this, but also as a result of natural variation of environmental qualities. As a consequence, there is necessary to implement general precautions to minimize the probability of causing irreversible damages on non-mapped environmental qualities. General recommendations for preventive actions are listed in table 4.

The exercise maps are dominated by a few large localities which mainly contains important areas for biodiversity and cultural heritage (figure 2). Due to the variations in both data quality and information sources, the size of localities may in some instances be too large. Furthermore, some localities might have been considered to have a higher environmental vulnerability than the actual value of the area. Furthermore, the localities may have different vulnerability at different time of year. In appendix 4, background information of the largest areas are given. It is recommended that the appendix is used with caution and in consultancy with environmental experts and local authorities when needed.

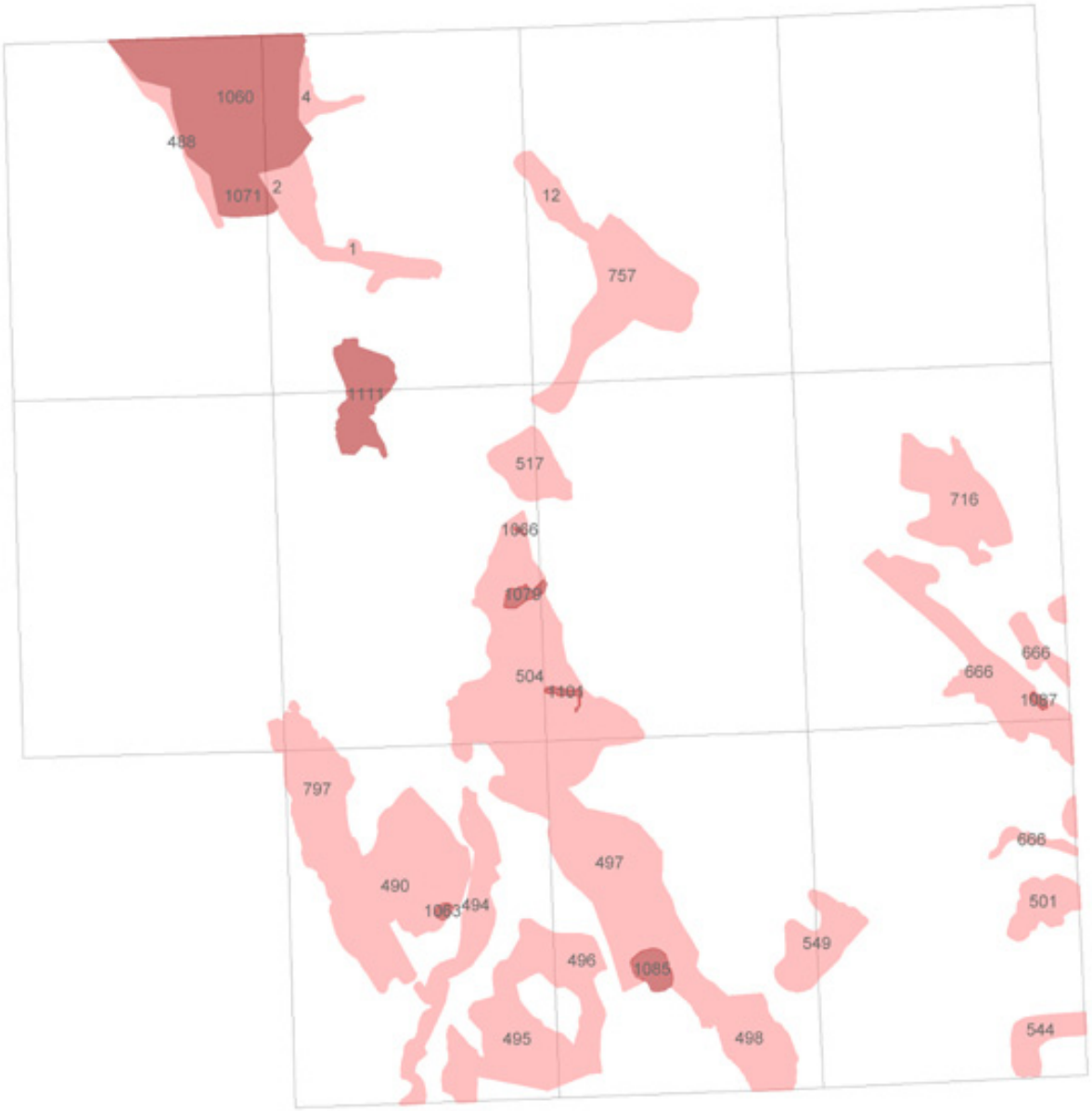

Figure 2. An overview of the largest localities on exercise maps, Iron Sword 2005

3.3 Challenges and recommendations

3.3.1 Risk analysis

The main objective of the risk analysis is to identify activities which may potentially come in conflict with environmental aspects. The risk analysis evaluates both consequences and the probability that negative effects will occur during the exercise. Both consequence and probability are scaled in three levels: low, medium and high. The evaluations are based on the specific activity pattern of Iron Sword, described in chapter 2.2.

By identifying the potentially most harmful activities, attention may be drawn to minimize negative effects of these and preventive counteractions can be effectuated. Table 3 summarizes the risk analysis.

Driving on roads

Cultural heritage

Consequence: High

In urban areas old township buildings and other installations are often built close to the roads. The settlements consist mainly of wooden buildings which are not very resistant to heavy traffic and vehicles.

In non-urban areas old village and spread settlements are often closely connected to communication systems. A main part of today's roads are built on or follow the old roads. Traditional wooden buildings and other installations are as a significant pattern situated very near or beside these roads. The settlements consist mainly of wooden buildings which can be fragile to heavy traffic and vehicles. In addition many of the existing roads (especially minor roads) are old, and in their own must be regarded as a part of the cultural landscape. Such roads were to a large extent built by man tools and are still characterized by stone masonry structures and other significant craftsmanship. Archaeological investigations have shown that new finds are very likely to be discovered near or beneath old roads due to their long use and tradition in these areas. While driving especially on minor roads with fragile fundaments in early summer season very short after the ground frost thaw there is a very high risk to damage to old roads and bridges, buildings and installations as well as unregistered archaeological sites close to the roads.

Probability: High

Due to the Iron Sword exercise pattern the risk of damage to cultural heritage objects closely connected to the communication systems are very high. Many of these roads are in themselves old and not built for large or heavy vehicles.

Driving on cultivated land

Noise pollution

Consequence: Medium

Driving on cultivated land might have negative impact on nearby noise sensitive agriculture as poultry farms, fox- and mink farms, horses etc. Disturbances might lead to stress, reduced production and death of animals. Such accidents will lead claims of economical compensation.

Probability: Low

Negative effects will only occur if driving is carried out close to noise sensitive agriculture. Noise sensitive agriculture are when information is given marked as prohibited areas on exercise maps. Furthermore, driving on cultivated land is in general forbidden, and therefore probability is considered as low.

Other challenges

Consequence: High:

The spreading of agricultural related diseases may cause large economical loss. Crops of seed potatoes are especially vulnerable for diseases like the potato cyst nematode. Fields where seed potatoes are grown must be considered as out of bounds areas to avoid the spreading of diseases to such areas. In general, all traffic of personal and vehicles should be avoided on crop land.

Probability: Medium

Driving on cultivated land is forbidden, and this reduces the risk of spreading diseases. However, also driving on the edge of ditches and on cart roads trough cultivated land may contribute to dispersal of diseases. Experiences from earlier exercises shows that this is likely to occur. The probability is therefore been evaluated as medium. It is important to be aware of that such diseases also may be found and dispersed from other areas than cultivated land such as residential areas etc.

Driving in outlying fields

Biodiversity

Consequence: High

Driving in outlying fields may cause changes in surface structure and lead to draining of moist areas and long lasting negative effects for biodiversity. Also forest types with vulnerable ground cover as pine lichen forest are sensible for this type of activity. The exercise is carried out at a time of year with no ground frost and snow cover, and this amplifies the extent of such damage. In addition, driving in outlying fields may cause disturbance to many wildlife species which have their breeding season in this period.

Probability: Low

Avoiding protected areas on the exercise maps will not fully ensure that no negative effects on biodiversity occur. Draining may cause negative effects in large areas, and not all areas with breeding wildlife species are marked on the environmental maps. However, in the exercise Iron Sword, most activities will take place in urban areas and motorized traffic will be limited to public roads. Therefore due to the exercise pattern, the probability of this activity causing negative effects on biodiversity in this exercise is low.

Outdoor life

Consequence: High

Driving in outlying fields may cause damage to much used outdoor areas, e.g. tracks and nature areas of high aesthetic value. The exercise is carried out at a time of year with no ground frost and snow cover, and this amplifies the extent of such damage. In addition the immediate quality of outdoor activities can be negatively affected due to visual presence and noise from military vehicles.

Probability: Low

Important track and outdoor areas are marked on the exercise maps. Many such areas overlap important localities for biodiversity. If the restrictions shown on the environmental maps are followed, this will greatly reduce the probability of negatively affecting outdoor life activities by driving in outlying fields. Also, because the exercise mainly will take place in more densely populated areas, the probability that serious effects on outdoor life activities may arise, is evaluated as low.

Cultural heritage

Consequence: High

Driving in outlying fields may damage surface structures and lead to changes in cultural landscapes. Archaeological findings are especially vulnerable, and very often not visible above the ground. Simple outlying field buildings are also vulnerable to traffic together with fences, tracks, simple roads, bridges and other installations. The exercise is carried out at a time of year with no ground frost and snow cover, and this amplifies the extent of such damage.

Probability: Low

Avoiding protected areas on the exercise maps will not fully ensure that no negative effects to cultural heritage. Only a limited amount of archaeological findings are registered. Many buildings, works and installations from pre-industrial times and cultural landscapes around these are also to a large extent unregistered. Examples of this are forest and mountain dairy pasture farming buildings, small lumberjack houses in timber, log floating installations cattle tracks, farm roads and other installations. Probability is rather limited since most Iron Sword activities will take place in urban areas and motorized traffic will be limited to public roads

Fuel distribution

Pollution

Consequence: High

Fuel distribution may cause spill of large amounts of fuel. Spill may disperse over large areas trough rivers and drain systems and this might have negative impact on drinking water sources, biodiversity and aquaculture far from spill sites. Whole population of species like fish, birds, water living mammals etc may go extinct following serious episodes of pollutions.

Probability: high

Spill is most likely to occur during multiple filling of cans, filling from cans, accidents with large vehicles, use and filling of aggregates and during maintenance and repairing of vehicles engines. Fuel distribution will mostly take place in existing road network reducing the probability of pollution. However, important drinking water sources, lakes and water systems are located nearby densely populated areas and roads. Some of this localities are marked on the environmental maps, however the registrations may be insufficient. Also beware that fuel pollution may be transported for long distances through small streams to such vulnerable localities.

Personnel by foot

Biodiversity

Consequence: Medium

In the breeding season personnel by foot may negatively influence breeding wildlife species. The amount of this negative influence varies in proportion with the number of people, the duration of their presence and each species tolerance to disturbances. Small groups passing by may be of minor importance, while larger groups of people may cause serious effects due to long term stress. However, some breeding bird of prey is especially vulnerable and may also be negative influenced by small groups passing by.

Probability: Low

Even though restrictions shown on the environmental map are followed, personnel by foot may influence biodiversity negatively. Not all vulnerable breeding sites are mapped and some species are not distributed in such clearly defined areas. However, the probably for such disturbance to occur is low due to the exercise pattern mostly excluding activities in outlaying fields.

Cultural heritage

Consequence: Medium

In early summer season when ground is still wet personnel by foot may negatively influence fragile heritage installations. Archaeological findings are especially vulnerable. The extent of this negative influence varies in proportion with the number of people and the duration of their presence.

Probability: Medium

The probability that negative influence on vulnerable objects will occur is low in this particular exercise due to the exercise pattern excluding activities in outlaying fields. However, a lot of heritage objects, registered and not-registered, are situated close to the roads and call on precautions.

Bivouacking

Biodiversity

Consequence: Medium

Bivouacking leads to a presence of personnel for a longer period of time, and may stress breeding wildlife species. Additionally, bivouacking may include cutting of trees and increased terrain wear which also have negative effects on biodiversity.

Probability: Low

Because not all breeding sites are marked on the map nor all species distributed in clearly defined areas, bivouacking may influence biodiversity negatively even though protected areas on exercise maps are avoided. However, as mentioned above, the exercise pattern of this particular exercise reduces the probability of bivouacking in vulnerable breeding sites.

Outdoor life

Consequence: Medium

Bivouacking leads to a presence of personnel for a longer period of time. Such presence in much used outdoor areas may negatively affect the immediate quality of outdoor activities. Additionally, bivouacking may cause logging of trees and increased terrain wear and long lasting negative effects in much used outdoor areas.

Probability: Medium

Important outdoor areas are marked on the exercise maps. Many such areas overlap important localities for biodiversity. If the restrictions shown on the environmental maps are followed, this will greatly reduce the probability of negatively affecting outdoor life activities by bivouacking activities. However, many of the locally important areas for outdoor life are located nearby populated areas and registrations of such localities may be insufficient. Due to the exercise pattern, this may increase the probability for conflicts to occur in such areas.

Cultural heritage

Consequence: Medium

Bivouacking leads to a presence of personnel for a longer period of time, and often to some kind of preparation of the ground prior to the camp construction. Such presence in outlying fields may damage terrain and fragile cultural landscape including unregistered archaeological sites near the surface.

Probability: Low

The exercise pattern of this particular exercise reduces the probability of bivouacking in vulnerable cultural landscapes. Old settlements and unregistered archaeological sites near the roads could although be influenced by the training activity.

Pollution

Consequence: Medium

Bivouacking may include handling of fuels and might have negative impact on drinking water sources, biodiversity and aquaculture far from spill sites. Even a few litres of fuel can pollute a small stream.

Probability: Medium

The exercise pattern of this particular exercise reduces the probability of bivouacking in areas with vulnerable biodiversity. However, lakes and water systems drinking water sources are located in close connection to densely populated areas and roads. Pollution may also be transported for long distances through small streams to important aquatic localities for biodiversity.

Building firing positions

Biodiversity

Consequence: Medium

Building firing positions leads to a presence of personnel for a longer period of time. Such presence in wildlife areas may stress breeding wildlife species. Additionally, building firing positions may cause cutting of trees and increased terrain wear which also have negative effects on biodiversity.

Probability: Low

Because not all breeding sites are marked on the map nor all species distributed in clearly defined areas, building firing positions may influence biodiversity negatively even though protected areas on exercise maps are avoided. However, as mentioned above, the exercise pattern of this particular exercise reduces the probability of building firing positions in vulnerable breeding sites.

Outdoor life

Consequence: Medium

Building firing positions leads to a presence of personnel for a longer period of time. Such presence in much used outdoor areas may negatively affect the immediate quality of outdoor activities. Additionally, building firing positions may cause cutting of trees and increased terrain wear and long lasting negative effects in outdoor areas.

Probability: Medium

Important outdoor areas are marked on the exercise maps. Many such areas overlap important localities for biodiversity. If the restrictions shown on the environmental maps are followed, this will greatly reduce the probability of negatively affecting outdoor life activities by building firing positions. However, many of the locally important areas for outdoor life are located nearby populated areas and registrations of such localities may be insufficient. Due to the exercise pattern, this may increase the probability for conflicts to occur in such areas.

Cultural heritage

Consequence: Medium

Building firing positions leads to a presence of personnel for a longer period of time. This could cause negative influence on cultural landscape and heritage sites, both registered and unregistered. If building firing positions lead to cutting of trees and increased terrain wear damages may occur on fragile cultural landscape and archaeological findings, especially in outlying fields.

Probability: Low

Because not all heritage sites are marked on the map, building firing positions may influence cultural heritage negatively. The activity pattern of this particular exercise will reduce the probability of these problems with exception of areas near old roads.

Shooting/ bursting

Biodiversity

Consequence: Medium

Stressing activities like shooting and bursting may influence breeding wildlife species negatively. Single shooting/bursting episodes will not be serious. However, continuous activity over large areas may have serious consequences on pregnant ungulates. Further, the negative effects is amplified in areas housing larger accumulation of individuals.

Probability: Low

Deer, including pregnant individuals, may be present in large parts of the exercise area, and the presence of larger accumulations of individuals will not be known. However, due to the exercise pattern the probability of this type of activity taking place in such vulnerable areas will be low.

Outdoor life

Consequence: Medium

Continuous shooting and bursting for a long period of time may negatively affect the immediate quality of outdoor activities.

Probability: Medium

Shooting and bursting may have negative effects over a long distance from where the activity is carried through. Even though restrictions on the exercise maps are followed, and this activity is only carried out in urban areas, it may negatively affect the immediate quality of outdoor activities.

Noise pollution

Consequence: High

Shooting and bursting may have negative impact on nearby noise sensitive agriculture and vulnerable public institutions. Shooting and bursting nearby noise sensitive agriculture might lead to stress, reduced production and death of animals. Such accidents will lead claims of economical compensation. Shooting and bursting nearby health institutions, asylum centres, cemeteries etc. may cause fear, stress and traumas.

Probability: Low

Negative effects will only occur if shooting and bursting is carried out close to noise sensitive agriculture or vulnerable institutions. The exercise is carried out in populated areas with a large number of vulnerable localities However, such localities are when information is given, marked as prohibited areas on exercise maps which reduces the probability of conflicts.

Low level flying (fighter/ helicopter)

Noise pollution

Consequence: High

Low level flying over groups of ungulates may lead to stress and contribute to raised levels of mortality and reduced reproduction. In the calving period high level of stress may lead to spontaneous abortion in pregnant ungulates. Additionally, brooding bird of prey may leave the nest resulting in failed breeding attempts. Low level flying nearby noise sensitive agriculture might lead to stress, reduced production and death of animals. Such accidents will lead claims of economical compensation. Nearby health institutions, asylum centres, cemeteries etc. low level flying may cause fear, stress and traumas.

Probability: High

Particular information of areas with high densities of ungulates will not be available during the exercise, partly because such fauna may be present in most of the exercise area. Some brood areas of bird of prey are shown on the environmental maps, but these areas are not marked as out of bounds areas. Together, this indicates that low level flying activities probably may have large negative effects on biodiversity in the study area. The exercise is carried out in populated areas with a large number of vulnerable localities. However, such localities are when information is given, marked as prohibited areas on exercise maps which reduces the probability of conflicts.

Amphibious operations

Biodiversity

Consequence: High

Amphibious operations may cause damage to the bottom substrate in rivers and lakes which are important areas for several invertebrate species and spawn- and growth areas for fish. In addition, many birds and some mammals have their breeding areas in connection to lakes and rivers. The presence of personnel and vehicles in such areas for long periods of time may therefore have negative effects to breeding wildlife. Water and organic material being stored in vehicles during such operations may spread alien species between water systems in the exercise area.

Probability: Low

Because there exists limited information of important areas for fish and invertebrates in lakes and rivers, following the restrictions on the exercise maps can not guarantee that amphibious operations do not take place in so far unidentified vulnerable areas. However, the probability that such areas are negative influenced is low due to the exercise pattern in Iron Sword 2005.

Outdoor life

Consequence: Medium

Lakes and rivers are much used outdoor areas, especially for fishing in this time of year. By the presence of personnel and vehicles for longer periods of time, amphibious operations may negatively affect the immediate quality of outdoor activities in such areas. Amphibious operations may also cause increased terrain wear and long lasting negative effects in much used outdoor areas.

Probability: Low

Most of the easily accessible areas along rivers and lakes are much used outdoor areas, but not all of these areas are marked on the exercise maps. Following the restrictions on the exercise map will therefore not ensure that this activity does not negatively affect the quality of outdoor activities. However, the negative influence probably is not large in this particular exercise due to the exercise pattern in Iron Sword excluding activities in outlaying fields. Organized amphibious operations will only be carried out in areas purposed for this activity, reducing the negative effects to outdoor activities.

Cultural heritage

Consequence: High

Amphibious operations may cause damage to cultural landscape and heritage sites near the lake and river shores. Very long hunting and fishing traditions in these areas have resulted in localities where unregistered archaeological finds are likely to be found. Still there are a large diversity of small boat houses, log floating installations lumberjack houses and similar closely connected to lakes and rivers. River and lake shores are also known as high potential areas for archaeological findings from the stone age.

Probability: Low

The probability of negative influence on such vulnerable areas is low due to the activity pattern in Iron Sword 2005.

Pollution

Consequence: High

Oil and fuel spill during amphibious operations might cause large negative effects on drinking water, biodiversity and outdoor activities.

Probability: Low

It should be taken into consideration that water temperatures are low and that some rivers may have high water level if snow melting is late. This may complicate amphibious operations and increase the risk of pollution.

Military boat traffic

Biodiversity

Consequence: Medium

By disturbing wildlife species as breeding birds and mammals in water systems military boat traffic may influence biodiversity negatively. Repeated boat traffic and landing operations in the same areas for a longer period of time will have the most negative impacts.

Probability: Low

Boat traffic will not likely be extensive in exercise Iron Sword 2005. This reduces the probability of negative effects regarding this activity.

Outdoor life

Consequence: Low

Lakes and rivers are much used outdoor areas, especially for fishing in this time of year. Repeated boat traffic and landing operations in the same areas for a longer period of time may negatively affect the immediate quality of outdoor activities in such areas.

Probability: Low

Boat traffic will not be extensive in Iron Sword. This strongly reduces the probability of negative effects regarding this activity.

3.3.2 Environmental challenges and recommendations for preventive actions

Table 3 gives and overview of environmental challenges at different activities during exercise Iron Sword 2005. Recommendations for preventive actions in relation to the challenges are presented in table 4.

Table 3. Overview of environmental challenges at different activities, Iron Sword 2005.

Activity	Challenges
Driving on roads	Driving on roads, especially with large and heavy vehicles, may cause damage to cultural heritage consisting of old roads and settlements.
Driving on cultivated land	Driving on cultivated land may cause spreading of agricultural related diseases. Driving on crop land in this time of year will cause large damages, leading to demands of economic compensation. If carried out nearby noise sensitive agriculture, this activity can cause stress, reduced production and death of animals, leading to demands of economical compensation.
Driving in outlying fields	Due to lack of ground frost and snow cover, driving in outlying fields in this time of year may cause serious and irreversible negative effects on biodiversity, outdoor life and cultural heritage.
Fuel distribution	Fuel distribution may cause spill of large amounts of fuel. Spill may disperse over large areas trough water systems and have negative impact on drinking water sources, biodiversity and aquaculture.
Personnel by foot	Because the exercise is carried out in the breeding season, personnel by foot may have negative impact on breeding wildlife species. In areas with wet ground, fragile heritage installations may be damaged.
Bivouacking	Bivouacking may cause stress to breeding wildlife species and increased terrain wear leading to negative effects on biodiversity, cultural heritage and outdoor life. Spill of fuel and chemicals near water courses during bivouacking may cause harm to aquatic environments.
Building firing positions	Building firing positions may cause stress to breeding wildlife species, and increased terrain wear leading to negative effects on biodiversity, cultural heritage and outdoor life.
Shooting/ bursting	Repeated episodes of shooting and bursting may cause stress and contribute to raised levels of mortality and reduced reproduction in some wildlife species. It may also negatively affect the immediate quality of outdoor activities. Shooting and bursting nearby health institutions, asylum centres, cemeteries etc. may cause fear, stress and traumas.
Low level flying (fighter/helicopter)	Low level flying may cause stress and contribute to raised levels of mortality and reduced reproduction in ungulates and brooding bird of prey. Low level flying nearby noise sensitive agriculture might lead to stress, reduced production and death of animals. If carried out nearby health institutions, asylum centres, cemeteries etc. low level flying may cause fear, stress and traumas.
Amphibious operations	Amphibious operations may cause damage to bottom substrate important to many fish and invertebrate species. Increased terrain wear close to rivers and lakes may negatively influence biodiversity, cultural heritage and outdoor life. Oil and fuel spill during amphibious operations might cause large negative effects on drinking water, biodiversity and outdoor activities.
Military boat traffic	Extensive military boat traffic may be disturbing to breeding wildlife species and negatively affect the immediate quality of outdoor activities.

Table 4. Recommendations for preventive actions at different activities, Iron Sword 2005.

Activity	Recommendations
Driving on roads	Avoid driving with heavy vehicles on and along cart roads and old minor roads.
Driving on cultivated land	All driving on cultivated land must be prohibited during the exercise. Also avoid driving on the edge of ditches and on cart roads running trough cultivated land. Driving must not be carried out close to farm buildings or in areas with animals on grazing land.
Driving in outlying fields	Driving in outlying fields must be kept to a minimum. In any case, areas with wet or in other way fragile ground must be avoided. Due to time of year motorized traffic is prohibited in all areas that are marked on the exercise maps, regardless of restriction class.
Fuel distribution	Refuelling areas must not be localized near water sources. The ground must be well suitable for reducing damages from spill (asphalt, concrete etc.). Reservoirs for collecting spill must be made at refuelling sites. Polluted soil must be deposited according to the local authorities recommendations. Handling routines for used absorbents must be available. Used absorbents and other dangerous waste must be delivered to an approved waste disposal station. Protective equipment and data sheets of dangerous substances must be available. Equipment to reduce damages and dispersal of spill must be available at refuelling sites and during fuel transport. Routines to alert and effectuate preventive actions must be available and followed.
Personnel by foot	Areas where all military activity are not allowed are marked on exercise maps. In addition, larger groups (more than 20) of personnel by foot should avoid areas marked as "Bivouacking prohibited" as much as possible.
Bivouacking	Areas where bivouacking are not allowed are marked on exercise maps. In general, bivouacking should be kept to a minimum in outlying fields. Bivouacking should if possible take place in areas with dry ground resistant to terrain wear. Cutting of trees and ground preparation should be kept to a minimum. To prevent fuel and chemicals to reach watercourses all handling of such should as a precaution take place more than 50 meters from water. Prior to the exercise, a waste handling plan including maps with location of waste disposal stations must be established. Routines for waste handling must be followed. Bivouacking must not be allowed within a distance of 50 meters from populated buildings.
Building firing positions	Areas where all military activity are prohibited are marked on exercise maps. In addition, building firing positions must be avoided as much as possible in areas marked as "Bivouacking prohibited". Cutting of trees and ground preparation should be kept to a minimum.
Shooting/ bursting	Shooting/ bursting is not allowed within a distance of 200 meters from vulnerable institutions and agriculture vulnerable to noise. Such areas are marked as prohibited on exercise maps where information is given. Combat actions in populated areas must only be conducted in agreement with local authorities, including subsequent information to local inhabitants. Shooting in populated areas must not be allowed between 23.00 and 07.00. Church time and funerals must be respected. In general, combat actions in populated areas ought to be restricted in time. Shooting activities should when possible be carried out at or nearby areas designed for such purposes. Civil shooting ranges are when information is given marked on maps in appendix 3. Due to time of year shooting and bursting should be avoided within areas marked as "Bivouacking prohibited".
Low level flying (fighter/ helicopter)	Low level flying must not be allowed within a distance of 500 meters from sensitive public institutions and agriculture sensitive to noise (marked as prohibited areas on exercise maps). Arrangements for landing sites must be made and local inhabitants must be informed in advance.
Amphibious operations	Amphibious operations should only be conducted in areas that earlier have been used and are considered to be suitable for this kind of activity. During amphibious operations driving along lake- and river shores must be kept to a minimum. An emergency system to combat oil pollution must be established. Warning routines must be followed and preventive actions must be taken in case of accidents.
Military boat traffic	Due to time of year military boat traffic should be avoided in areas marked as bivouacking prohibited on exercise maps. To prevent negative effects on outdoor life, military boat traffic should be avoided in late evenings and weekends. Any extensive use of military boats should be evaluated in detail in advance of the operations.

"Showing force" activity may be desirable to accomplish in areas close to public institutions. According to the exercise maps, all military activity are however prohibited in such areas. This kind of activity will not cause large negative influence, and may still be advisable to carry out. Approval from local authorities should although be obtained.

3.3.3 Other important aspects

In addition to the activities discussed above, there are other special precautions that need to be taken. Prevailing regulations in the NJHQ's *Directive on export/ import of military personnel and equipment into and out of Norway* must be followed to prevent spreading of alien species and diseases.

Furthermore, it is essential that alien species and diseases are not spread into or within the exercise area. Preventive routines must therefore be implemented. To reduce the risk of spreading alien species and diseases, water and biological material (including human waste) should consequently not be transported between different river systems. Routines for disinfection must be carried out when equipment has been used in watercourses that are declared as infected zones by The Norwegian Food Safety Authority in accordance to "*Forskrift om forebygging, begrensning og utrydding av sykdommer hos akvatiske organismer*". Within the exercise area, Glomma river south of Braskreidfoss in Våler municipality is considered as infected zone due to water mold on crayfish has been proven. If equipment has been used in this or other infected zones, environmental officers should be contacted. For more information, contact the local or regional office of The Norwegian Food Safety Authority (contact info, appendix 1).

As mentioned above, the spreading of agricultural related diseases may cause large economical loss. Crops of seed potatoes are especially vulnerable for diseases like the potato cyst nematode. Fields where seed potatoes are grown must be considered as out of bounds areas to avoid the spreading of diseases to such areas. Information of seed potato producers in different municipalities is obtained from the county authorities in Hedmark (appendix 6). Marking of areas should be carried out in cooperation with the seed potato producers.

Waste handling must be carried out due to routines ensuring that soil, air or water is not polluted, and that litter do not cause negative effects on outdoor life. A separate plan for waste handling during exercise Iron Sword 2005 will be established. The plan must be followed independently of any changes in the exercise.

3.4 Efforts reducing environmental damages

Listed below are recommendations to reduce environmental damages before, during and after exercise Iron Sword 2005. NDEA, MIKU can be contacted in need of additional environmental consultancy.

3.4.1 Before the exercise

Informing civilians

Sufficient information of activities during the exercise and possible environmental damages, may reduce negative experiences of military presence. Therefore, a press release should be realist prior to the exercise. To inform local authorities, landowners and other institutions, meetings should be hold before the exercise. Information material should be distributed each household and institution by mail.

Informing and educating participants

Environmental protection officers (EPO) should acquire good knowledge of the environmental impact analysis. If possible, a seminar for EPOs should be arranged to improve and ensure uniform environmental work during the exercise. A standardized form for registration of damages must be composed.

To efficiently make use of the sampled environmental information, it is vital that selected personnel in central positions during exercise planning are sufficiently trained with GIS and also has available the necessary hard- and software together with prepared environmental information. In military exercises like Iron Sword this must be present in the coordinating environmental point of the exercise - The environmental cell (EC). Therefore, it is recommended that at least one person in the EC at any time during the exercise is sufficiently trained in GIS, and that at least one computer with necessary software and environmental information is present in the cell.

All participants of the exercise should be informed of the environmental main challenges in the exercise area. A pocketsize environmental protection folder should be distributed. Existing folders may be used as a framework and adjusted for the specific main challenges of this exercise.

Participants having little experience regarding Norwegian nature conditions must be educated to recognise problematic elements. Norwegian EPOs should inform all participants about suitable ground condition concerning motorized traffic.

Participants must be given relevant information about routines and regulations that shall be attended (oil spill preparedness, instructions for low level flying etc). Officers responsible of fuel handling must be given special training.

Reconnoitring

Routes in outlying fields that may be used for heavy motorized traffic must be inspected and, if possible, marked by EPOs.

Suitable areas for fuel distribution must be localized and approved by EPOs.

Areas suitable for parking are marked on the maps in appendix 3. If parking areas are required beyond this, EPOs must localize other suitable areas in consultation with local authorities and land owners.

New information acquired after reconnoitring must be distributed to all participating units.

Marking

Areas where military activity is likely but illegal have to be marked with signs “Out of Bounds”. The extent of marking must be evaluated in relation to local conditions and practical circumstances. Detailed information regarding localities marked on exercise maps are found in the digital data set which has been delivered NJHQ for use in GIS software.

3.4.2 During the exercise

Environmental protection officers	The most important task for the EPOs is to be the unit commander's environmental advisors. EPOs should contribute to the implementation of environmental considerations in all processes. The EPOs must stop operations that might cause irreversible environmental damages. EPOs must ensure that gained experiences and environmental recommendations for future operations are implemented in the exercises operational management. EPOs must follow their units from the deployment phase. Notable experiences obtained during the exercise must be included in the EPOs final report. Personnel handling fuel must be informed of routines and given training in use of protective equipment to prevent spill.
Environmental cell	An EC must be established. The main task for the EC should be to coordinate all environmental work during the exercise. The environmental cell has to record all incident communications, claims, and damages of both environmental and economical character. All damages/ claims must be plotted on an own map and recorded in a standardised journal. Information of type of damage, cause and extent must be noted. If possible should EPOs use GPS to get a precise location of the damages.

3.4.3 After the exercise

Inspection of the exercise area	Inspection of the exercise area must be carried out immediately after the exercise. The EC should organize and establish a plan for the inspection. To reveal possible damages in outlying fields air surveillance should be conducted.
Damages	Environmental damages must as far as possible be repaired, even if there is no claim of economical compensation. If wanted, NDEA, MIKU can in cooperation with EPOs establish a plan for rehabilitation. Local environmental authorities must be informed of registered damages and actions for rehabilitations. Economical compensation for simple damages will be made during and after the exercise.
Clearing	Clearing has to be conducted immediately after the exercise. Clearing should be based on bivouac reports which all units must deliver to the EC. The EC is responsible for effectuation and coordination of clearing.
Evaluating – "Lessons learned"	An assessment of environmental aspects should be conducted after the exercise. The main goal for this assessment is to identify possible environmental improvements utilized in future exercises. Local authorities should be invited to a meeting and be given the possibility to contribute with their experiences gained during the exercise.

Appendix

Appendix 1. Contact information - local authorities

Local authority	Contact	Phone
Stange municipality	Leif Skar	62 57 36 53
Åsnes municipality	Frode Jacobsen	62 95 66 64
Løten municipality	Torleiv Yli Myre	62 59 30 71
Våler municipality	Rolf Lie Holter	62 42 03 00
Elverum municipality	Lars Sæhlie	62 43 31 13
Hamar municipality	Torleiv Yli Myre	62 51 02 60
Ringsaker municipality	Janne Brovold	62 33 53 06
Stor Elvdal municipality	Håvard Haug	62 46 24 36
Åmot municipality	Terje Bjørgmo	62 43 43 10
Trysil municipality	Bjørn Tore Bekken	62 45 77 45
County Governor of Hedmark (Environment)	Hans Christian Gjerlaug	62 55 11 82
County Governor of Hedmark (Agriculture)	Lars Martin Hagen	62 55 12 54
County Authorities Hedmark	Ketil Skare	62 54 45 35
The Norwegian Food Safety Authority	-	62 33 14 00

Appendix 2. Explanation of the attribute table

Attribute	Explanation
REG_ID	Unique identity number for each single locality.
F//P _TEME	Gathered information categorized after type of restriction (number)
CATEGORY	Gathered information categorized after type of restriction (string)
OBJECT_1-5	Gathered information categorized after type of object/ environmental aspects
SOURCE	Information about who have delivered information to NDEA during data gathering.
DATE	Date of production of data set
DIGSCALE	Scale used when digitizing theme maps. 50000 = 1: 50 000, 60000 = 1: 60 000 etc.
PRODUCER	Producer of the data set.
COMMENTARY	Additional information about localities where such information are present

Appendix 4. Background information of the largest localities

Locality	Commentary
1060, 1071, 488, 1, 2, 4	The area consists of "Rondane sør" which is proposed as protected area due to a very high importance as calving area for reindeer. The municipalities have in addition reported adjoining areas based on local information. The area is of greatest importance for reindeer during summer, and should therefore be avoided during exercise Iron Sword 2005. In the future, some of the area might be utilized in exercises during winter with exception of the prohibited area.
1111	Protected area (Lavsjømyrene). The area has environmental qualities of international value with a intact bog landscape with a very vulnerable flora and fauna. The area is therefore prohibited during all seasons.
12, 757	Important area for biodiversity and cultural heritage. The area has great environmental qualities with a intact bog landscape, oxbow lakes and a vulnerable flora and fauna. In addition the whole area is important as a grazing area for moose during winter and contains old hunting systems of pit-fall traps. Use of vehicles should be carried out with precautions and only by allowed during winter, provided sufficient ground frost and snow conditions. Areas with large accumulations of moose during winter should be reconnoitred and avoided.
517	The area contains a large number of vulnerable archaeological localities (hunting systems of pit-fall traps, iron production sites etc.). It is therefore recommended that use of vehicles only is allowed during winter provided sufficient ground frost and snow conditions.
504, 1079, 1101, 1085, 497, 498	The area contains two protected areas "Årkjølen" and "Vesle Rokosjøen". Important cultural heritage are mainly located in the northern part of the area (grave cairns, grave mounds etc.). The area is very important as grazing area for moose from the whole region during winter, which explains the large extent of the area. Furthermore, the southern parts have a high diversity of bird of prey, which are very vulnerable to noise and human presence during the breeding season (from early spring to august). In conclusion, the centre and northern part of the area, with exception of the protected areas, are expected to be less vulnerable to military activity during exercise Iron Sword 2005 than the southern parts. The areas vulnerability is however inverted during autumn and winter, as moose starts to utilize the area in a larger extent.
496, 495, 494, 797, 490	The area has a high diversity of bird of prey and wetland birds, which are very vulnerable to noise and human presence during the breeding season (from early spring to august). Furthermore, the north-western part of the area contains cultivated landscape of national importance. It is recommended to minimize all military activity in the whole area during exercise Iron Sword 2005.
549	The area is a important grazing area for moose, and has a relative high diversity of wetland birds. The area is especially vulnerable in spring and summer season, but precautions should also be taken during winter.
716	The area has a relative high diversity of wetland birds, and is especially vulnerable in spring and summer season.
666, 1087	The area is a very important grazing area for moose, and contain a smaller protected area that has environmental qualities of international value with a intact bog landscape with a very vulnerable flora and fauna.
501	The area is a important grazing area for moose.
544	The area is a important grazing area for moose.

Appendix 5. Attribute table

The attribute table is delivered to NJHQ for further distribution to EPOs etc.

Appendix 6. Seed potato producers within the exercise area, Iron Sword 2005

Producer	Municipality
KNUT O AASVESTAD	Hamar
HAGENE JON MATIAS	Ringsaker
GRETHE SLOTNÆS	Ringsaker
FROGNER HANS	Ringsaker
RØHR ERIK	Ringsaker
MENGSHOEL EVEN	Ringsaker
MÆHLUM SIMEN	Ringsaker
SKYBERG SVERRE JR	Ringsaker
ØSTBY-DEGLUM OLAV	Ringsaker
SKYBERG PER ULVEN	Ringsaker
OLE M DOBLOUG	Ringsaker
HANS RUNE HAUGOM	Ringsaker
OLAV LEVERNES	Ringsaker
BJARNE KJØS	Løten
AUSTLID EILIV	Stange
HVEEM MARGRETE BJERTINGSTAD	Stange
OLE GJERLAUG	Stange
MAAGAARD TROND	Stange
THORUD JOHAN	Stange
RØHNE CHRISTIAN	Stange
TRONGAARD ANDREAS	Åsnes
IVAR BREDALEN	Åsnes
NYGAARD PER VICTOR	Åsnes
ROSTAD PER KRISTIAN	Åsnes
BREDVOLD TERJE AUDUN	Åsnes
WENSTAD PER OLAV	Åsnes
HÅKONSEN OLA HENNING	Åsnes
KJELL BJARNE ANSETH	Åsnes
LØFSGAARDEN ANS	Åsnes
ERIKSMOEN ERLING OLAV	Våler
OLE JAKOB BJØRNEBYE	Våler
SVENNEBY BREDE	Våler
ØSTBYE BREDE KRISTIAN	Elverum