Title

RE-EVALUATING THE NEEDS FOR ANIMAL PASSAGES IN ISRAEL: TOWARDS A LONG-TERM MONITORING SCHEME

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RE-EVALUATING THE NEEDS FOR ANIMAL PASSAGES IN ISRAEL: TOWARDS A LONG-TERM MONITORING SCHEME

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Abstract

Centralized planning framework, accelerating habitat fragmentation and growing awareness to animal-transportation issues in Israel have lead to increased demand for ecological considerations during road construction and maintenance. Several governmental bodies have upgraded their requests regarding fauna passages and monitoring, with substantial budget implications.

Planning and management decisions on local and regional scale need to consider changes and adaptations required with time. Current project-oriented planning and budgeting make it difficult to maintain a regional, long-term view.

Most existing fauna passages were not specifically designed for animals. Guidelines for animal passages are derived from European countries, which differ from Israel in climatic-ecological aspects and in some human activity patterns.

Adapting these guidelines to local conditions in order to rationalize and optimize planning, expenditure and results requires more accurate reevaluation of animal needs, testing alternative solutions on small scale before turning to large-scale expensive modifications, and responding to temporal changes.

1. Objectives

This paper presents a project proposed to the Israel National Road Company. The project has 3 objectives: a) Estimate if existing available passages match the connectivity needs of various species; b) Evaluate if, how much and where animal road crossing poses a genuine safety problem to humans; c) Compare various data sources and collection methods and devise a cost-effective long-term monitoring scheme and indicators.

2. Methodology

Several stages are proposed:

I) Identifying "hotspots" or "bottlenecks": using GIS mapping to overlay existing data from various sources in order to locate areas that need attention.

II) Pilot intensive monitoring: intended to assess the efficiency and suitability of existing passages by several criteria and to compare between several monitoring techniques and data sources.
Interim summary of results will lead to further specific monitoring.

III) Devising a long-term monitoring scheme and testing it.

3. Anticipated Results

The initial data collection should point at:

- Specific "hotspots" or "bottlenecks" with high collision rate and/or where connectivity is impaired.
- Species or habitats that need extra attention.
- Locations where safety problems may occur.

Pilot monitoring should:

- Reveal more details on the usage of various passage types and its relation to certain environmental parameters
- Compare different monitoring methods.

4. Implications and Recommendations

The interim summary will recommend on required action: fencing, modifications to existing passages and testing for their effectiveness, additional passages. It will recommend on cost-effective monitoring: techniques, scale, optimal data sources and indices (new or from upgraded existing sources). Further research will be recommended according to results.

The long-term monitoring scheme should detect changes through time deriving from changes in human activity patterns and development, and/or changes in faunal populations, their behaviour and needs. It should enable to point at sensitive areas and at issues that require response.

Introduction

Background

Natural habitats and open landscape in Israel are facing accelerated habitat loss and fragmentation due to high development pressures, particularly at the center of the country. The northern part of the country, with a Mediterranean to semi-arid climate, is densely populated and more fragmented by infrastructure; the southern part of the country, with semi-arid to arid climate, is sparsely populated and infrastructure still leaves relatively large habitat patches.

Regional planning is centralized through the Planning Administration at the Ministry of Interior and its national and regional committees. Numerous master plans address various planning issues including Infrastructure and several categories of protected areas. An increasing awareness to connectivity and transportation issues emerged ca. 10 years ago. The main actors in this scene, apart from the planning authorities, are the Nature and Parks Authority (NPA), the Ministry of Environmental Protection, the National Road Company (NRC) and the Cross-Israel Highway Company (NGOs also play a role).

Tight planning regulations and increasing awareness to animal-transportation issues have lead to increased demand for ecological considerations during road construction and maintenance in the last few years. Several governmental bodies have upgraded their requests regarding fauna passages and monitoring, with substantial financial implications: more passage are required where roads are upgraded, and planners are requested from as general as attention up to a detailed monitoring scheme.

Most of the animal passages available today in Israel are either water conduits in various sizes and shapes or agricultural passages, not specifically designed for animals or their needs. They are not maintained on a regular basis. In the last 5 years, 6 overpasses have been planned. Three are now operational.

Studies and Monitoring

Since 2000, several reviews, studies and short-term specific monitoring on connectivity and wildlife were carried out in Israel, mainly initiated by NPA (e.g. Baki 2000, Gutman *et al*. 2002, Inbar *et al*. 2002, Malichi 2006, Achiron-Frumkin & Frumkin 2007). They were accompanied by a general definition of "Ecological Corridors" and ecological "bottle necks" as guidelines for regional planning (Shkedy & Sadot 2000), and by guidelines for animal passages, recently updated by the NRC (Shkedy & Sadot, 2004, Avnon 2008).

NPA are currently refining their definitions for ecological corridors and test more data sources and monitoring equipment.

There is a notion that animal-vehicle collisions are not a major safety issue. According to the NRC engineers, there are no human-safety problems arising from animal-vehicle collisions, except from collisions with domestic camels and donkeys, mainly along a few roads crossing the Negev desert. Yet, this has not been checked thoroughly, as well as cases where there was no kill, but the driver was startled or the distracted attention eventually caused an accident.

The Fauna: Who Is It For?

Large mammals like elk, moose or bear are absent from the Israeli fauna. The more common large herbivores are two gazelle species and Ibex. Other medium-sized mammals include Wild Boar, Striped Hyena, porcupine, badger and otter, to name few of the large to medium-sized ones.

Several grazing species were re-introduced and are found at specific areas (Onager and Arabian Oryx in desert habitats and Roe Deer and Persian Fallow Deer in Mediterranean habitats)

The Need

The current guidelines and recommendations for animal passages (Avnon 2008) were mainly derived from the experience in European countries (e.g. Iuell *et al*. 2003), where faunal composition, habitats, climate and human activity patterns are different from those in Israel. Moreover, the experience worldwide has led to modifications and improvements that need to be looked at and checked for local suitability.

Adapting the guidelines to local conditions, as several European countries have done (e.g. Rijkswaterstaat 2005, Ministra de Medio Ambiente 2006) is required in order to rationalize and optimize planning, expenditure and results. Choosing between alternative connectivity solutions should be based on hard evidence and on pilot experience before turning to large-scale expensive modifications.

The insights from the preliminary studies mentioned above are insufficient for making more accurate planning and management decisions, such as the number of passages, their design and their maintenance.

Furthermore, planning and management decisions on local and regional scale need to consider changes and adaptations required with time. Current project-oriented planning and budgeting make it difficult to maintain a regional, long-term view. The current procedures are also insufficient to allow for changes and adaptations that are required with time – responding to local animal populations' dynamics and to changes in their movement requirements, as well as to changes in human activities in the surrounding open landscape and to the interaction of both.

This paper presents a project proposed to the Israel National Road Company.

Objectives

The proposed project has three objectives – to find out the magnitude of the animal-road infrastructure problem, both to animals and to people in different regions, to recommend on possible solutions, and to device an optimal monitoring scheme:

a) Evaluate if the existing passages match the connectivity needs of various animal species;
b) Evaluate if, how much and where animal road-crossing poses a genuine safety problem to humans;
c) Compare various data sources and collection methods and devise a cost-effective long-term monitoring scheme and indicators.

Addressing these issues should enable planners, engineers and conservationists to:

1) Locate where connectivity needs do not correspond to existing and planned setup, and therefore:
    - Define priorities to find solutions (for areas or for specific roads of high priority);
    - Recommend on ways to improve connectivity in specific locations;
    - Test for the actual suitability of the applied solutions.
2) Compare between several connectivity options (including costs, maintenance, combined solutions), testing for efficiency and suitability using several criteria (animal movement needs, diversity of species using the passage, the degree of usage, seasonal variations, target species);
3) Decide on the appropriate monitoring scheme and techniques, which are suitable for the physical circumstances and comply with financial and administrative consideration, allowing to detect current and future problems.

Methodology

The proposed project involves several stages. As the whole project is expensive, it was intentionally designed in modules with distinct stopping points allowing to evaluate the results at each point and to decide if, how and when to proceed.

It involves gathering and analyzing existing available data from different sources, and based on this analyzed data – perform a pilot monitoring, gather new data simultaneously, if necessary, and use the conclusions for decision-making and to establish a long-term monitoring program.

The first stage includes collection and analysis of data from various existing sources; a pilot monitoring stage follows, where new data will be collected and compared to the existing available data; the results of the first two stages are summarized towards more detailed recommendations and towards testing the suggested long-term monitoring framework; and finally –an approved long-term monitoring scheme will be operated on the third and last stage.

It is important to note that when we try to assess animal needs and the level of suitability of the currently available passages there are two main issues: a) assessing the animal connectivity/ movement needs based on data from several sources; b) assessing the efficiency of existing passages to answer these needs, using several parameters (such as the diversity of species actually using the passage, the degree of usage, seasonal changes, special focus on species/ groups that were marked as targets).

To support the ability to take knowledgeable decisions and to promote the dialogue between different stakeholders, the proposal also suggests to: a) review the literature for updated monitoring possibilities, their efficiency and costs; b)

carry out two professional workshops to present the findings of stage 1 and stage 2 and to discuss the results and recommendations (both are not further mentioned).

Stage 1: Identifying "Hotspots" or "Bottlenecks"

Using GIS mapping enables to gather and overlay existing data relevant to connectivity, on a local, regional and national scale. The data sources include:

- Data from road kills (available data and data to be collected over a defined period);
- Observations on animal movements on or near roads;
- Reports on animal-vehicle collisions;
- Refined mapping of ecological corridors (NPA);
- Species distribution maps (particularly rare or endangered species);
- Habitat distribution maps (particularly aquatic habitats);
- Open landscape along roads, not necessarily included on the ecological corridors);
- Location of existing underpasses and their properties (shape, dimensions).
- Recommendations from current studies on other parameters important to connectivity analysis that need to be considered.

These will be analyzed for the degree of overlap between collision/kill data and ecological and physical data – with distribution maps, with ecological corridors, with other open landscape or with the distributions of certain focal species and habitats and with the availability and properties of passages.

This analysis should point at specific locations that need special attention ("hotspots" or "bottlenecks") – both generally, on a regional or national level, and for particular endangered species. It will also be able to verify or disprove the notion that basically there are hardly any passenger safety problems.

This stage should yield primary recommendations for specific solutions that can be tested later.

Stage 2: Pilot Monitoring

Stage 2 involves intensive monitoring in few selected "hotspot" sites. From the hotspot/bottleneck areas characterized on stage 1, 2-3 areas will be chosen for a pilot study, preferably located at the north, center and south of the country, to allow for different habitats. Monitoring will be conducted during both a rainy and a dry season.

Several monitoring techniques and data sources will be used and compared to examine usage patterns of existing passages and animal movement in their vicinity: recording kills, making direct observations, recording tracks in sand and ink beds, as well as using IR-cameras, that reveal a more comprehensive picture along with important behavioral data not otherwise available.

Additional parameters will be collected for the landscape and for specific passages so as to assess the efficiency and suitability of existing passages by several criteria.

The results will portray the actual usage of different types of passages, and its relation to various parameters. They will also help to compare between monitoring techniques and depict the parameters that should be collected and the costs involved.

Interim Summary of Results

The results of stage 2 will be used for:

1) Recommendations for fencing of problematic road sections;
2) Recommendations to modify and improve passage design and functionality;
3) Recommendations on where to test the effectiveness of the improvement measures before spending more time and money on their wide application
4) Deciding on the most cost-effective future monitoring:
    a. Where and how should it be expanded?
    b. Which data sources can be reliable indicators (for action required or for changes):
        - Which data yielded the most relevant information?
        - Do we need to develop new indicators or is it sufficient to keep collecting data (or upgrade it) from existing sources?

This stage should involve some form of consultation with various stakeholders to reach an accepted framework for long-term monitoring.

Stage 3: Towards a Long-Term Monitoring Scheme

Based on the recommendations from the previous stages, this stage involves devising a long-term monitoring scheme.

The monitoring scheme is intended to track changes emerging from the human side, from development and from changes in human activity patterns on one hand, and changes emerging from the animal side, from changes in animal populations and their needs on the other hand, or from both.

It will recommend on the preferred techniques, define the spatial (where to monitor) and temporal (how often) scale, define responsibilities for different organizations that may collect the data, the organization and analysis responsibilities and the budgets involved.

Anticipated Results

The initial data collection (stage 1) should point at:

- Specific "hotspots" or "bottlenecks" with high collision rate and/or where connectivity is impaired.
- Species or habitats that need extra attention.
- Specific locations where safety problems may occur.

The pilot monitoring (stage 2) should:

- Reveal more details on the usage of various passage types and its relation to certain environmental parameters
- Compare and rate different monitoring methods by several suitability criteria.

Implications and Recommendations

The interim summary will recommend on required action(s): fencing where many road kills or accidents occur; modifications to existing passages to improve their usage and the appropriate testing for the effectiveness of these modifications; planning for additional passages where required.

It will recommend on cost-effective monitoring: techniques, scale, optimal data sources and best predictors/ indicators for the questions of interest: for locations that need attention (change or solution) now or in the future, or for successfully handled problems? Which data sources yielded most relevant data? Should new indices be developed or can we upgrade existing data collection (such as carcass collection and removal by road safety teams)? It will consider if and where should monitoring be extended. Further research will be recommended according to the results.

The long-term monitoring scheme should depict an optimal way to track temporal changes deriving from various reasons (human or fauna related). It should enable to point at sensitive areas and at issues that require response, allowing conservationists and planners to work together towards finding optimal solutions for sustainable development. Such a scheme can be incorporated as part of a larger monitoring scheme which is to be included within the national strategy for biodiversity conservation.

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