REPORT

MONITORING OF BIODIVERSITY INDICATORS IN THE WEST BEQAA LANDSCAPE

PROJECT
"Building the ecologic and socio-economic resilience of the Shouf Mountain Landscape by restoring and strengthening the socio-cultural fabric which sustains its biodiversity and cultural values"

By Dr. Ghassan Ramadan Jarradi, Ornithologist, SPNL Scientific Advisor

TABLE OF CONTENTS

FOREWORD

Biodiversity Indicators are an important tool to inform management about the health and trend of biodiversity, as well as the integrity of ecosystems. Biodiversity indicators also tell us about the effectiveness of the conservation to face the threats, and the conservation response to the protection of important biodiversity habitats. In addition, the monitoring of Biodiversity indicators guide the managers about the benefits provided by the ecosystem services. This study-report followed strategic steps to identify and monitor the avian indicators of West-Beqaa Area in Lebanon.
Ghassan Ramadan-Jaradi

REPORT

MONITORING OF BIODIVERSITY INDICATORS IN THE WEST BEQAA LANDSCAPE

PROJECT

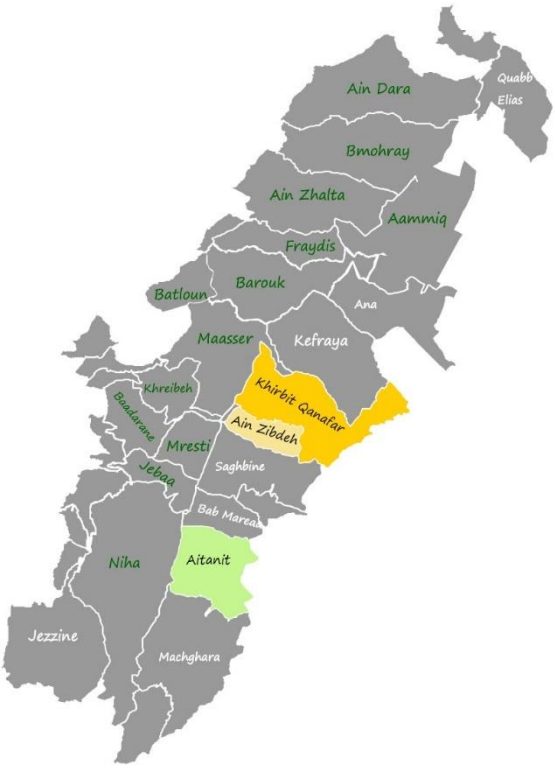
"Building the ecologic and socio-economic resilience of the Shouf Mountain Landscape by restoring and strengthening the socio-cultural fabric which sustains its biodiversity and cultural values"

This report is in line with the guidelines given by the project on the land use types and subtypes

I. INTRODUCTION

The West Beqaa Landscape is characterized by a gradient of environmental conditions – geomorphological and climatic features – resulting in three bio-climate zones: Mountain-Mediterranean (1500-1900 m), Supra-Mediterranean (1000-1500 m) and Meso-Mediterranean (500-1000 m). Thus, the West Beqaa lacks practically the Oro-Mediterranean zone of the ACS but includes the Meso-Mediterranean level that is not apparently present in ACS. The part of the landscape most modified by the human being is in the Supra and Meso-Mediterranean levels, due to the milder climate conditions and the complex geological features favoring the presence of deeper soils and higher soil water content and freshwater availability. The landscape is characterized by a mosaic of agriculture land, semi-natural woodlands and pastures. The Mountain- Mediterranean level keeps more natural conditions being characterized by different successional stages of forests and pastures.

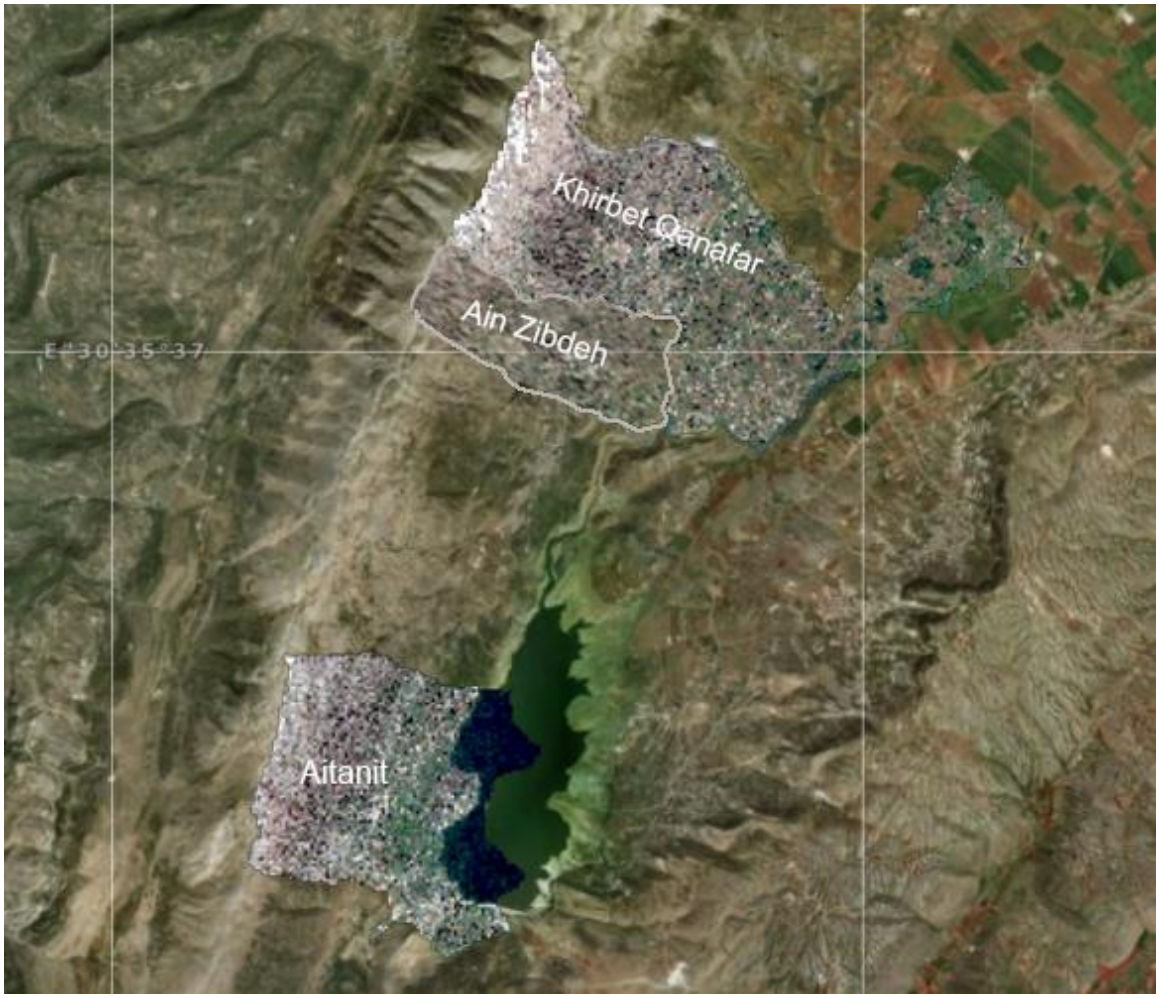
Accordingly, the land use types of the West Beqaa were investigated by SPNL in the Mountain-, Supra-, and Meso-Mediterranean levels. The investigation was limited to three Himas (Khirbit Qanafar, Ain Zibdeh and Aitanit) along the eastern slopes of the Shouf Mountain Landscape (Figure 1). The maximum height is 1918 meters a.s.l at Khirbit Qanafar and 1785 meters a.s.l at Aitanit. The minimum height is 853 meters at Khirbit Qanafar and 840 meters at Aitanit.



Location of three Himas on the map of Shouf/West Beqaa: Khirbit Qanafar, Ain Zibdeh & Aitanit.

In order to explore the various agro-sylvo-pastoral land-uses and the landscapes of the West Beqaa three Himas, it was necessary to verify the land uses types

already obtained from the examination of the google earth mapping. For this purpose, the SPNL that manages and knows well the Himas has examined maps of GeoEye 0.5 for the himas and organized field trips to the three sites (see below) focussing this time on 1) traditional practices that constitute the cultural heritage of the landscape and its biodiversity, 2) major threats impacting the landscape and the practices, 3) major pastoral lands, 4) various types and sub-types of farmlands and 5) sites and biodiversity elements that need restoration to their optimal conditions.



The three Himas on a GeoEye map.

Jamal Hamza, Ghassan Ramadan-Jaradi (SPNL), Elie Karam (Shepherd of Kherbet Qanafar), Shaweesh (municipality of Ain Zibdeh) and Antoine Selwan (Member of the Municipality of Aitanit) participated in these trips.

II. MAJOR LAND-USE TYPES AT WEST BEQAA

Orange font color indicates type/subtype not encountered or overlooked

Supra-Mediterranean Level (1000-1500 m)

1. Agricultural Land

1.1. Agricultural terraces (AT)

1.1.1. Productive AT (PAT)

1.1.1.1. PAT with tree crops, including olive trees, apples, and other fruit trees;

Terraces with olive trees at Aitanit

Terraces with apples at Khirbet Kanafar

Terraces with apples at Aitanit.

1.1.1.2. PAT with shrub-like woody crops, including vineyards, and aromatic shrubs;

Vigneyards on terraces for “Chateau Wine Qanafar”

1.1.1.3. PAT with vegetable crops;

PAT with Artichoke

1.1.1.4. Newly established PAT with no crops (or not yet productive recently planted crops)

1.1.2. Abandoned AT (AAT)

1.1.2.1. Recently AAT with abandoned woody crops

Recently AAT with abandoned woody crops (Aitanit)

1.1.2.2. Recently AAT with no crops

1.1.2.3. Mid-term AAT with herbaceous vegetation, sometimes with scattered native and/or previously cultivated trees

Mid-term AAT with herbaceous vegetation at Aitanit

1.1.2.4. Mid-term AAT with vegetation cover dominated by Sarcopoterium spinosum and Calycotome villosa “garriga” low shrubs, sometimes with scattered native and/or previously cultivated trees.

1.1.2.5. Mid-term to long ago AAT with more or less bare, eroded soils

Mid-term to long ago AAT with more or less bare, eroded soils

1.1.2.6. Long ago AAT colonized by tree/shrub shelterbelts, dominated by oaks (*Q. calliprinos, Q. infectoria*) and small trees from the *Rosaceae* family (Pyrus syriaca, Prunus spp), sometimes with scattered previously cultivated trees.

1.1.2.7. Long ago AAT colonized by more or less dense woodlands, dominated by oaks (*Q. calliprinos, Q. infectoria*), pines (*Pinus brutia, P. pinea*) or mixed oak-pine vegetation, sometimes with scattered previously cultivated trees.

Long ago abandoned Agriculture terrace colonized by pine trees at Ain Zibdeh.

1.2. Flatland agriculture (FA)

1.2.1. FA with tree crops including olive trees and fruit trees;

1.2.2. FA with low woody crops, mainly vineyards

Flatland with vineyard (Khirbet Qanafar).

1.2.3. FA with cereal and vegetable crops

Field of Artichoke at Ain Zibdeh

FA with tree crops including olive trees and fruit trees; and FA with low woody crops, mainly vineyards (Khirbet Qanafar).

FA with cereal and vegetable crops (here Potatoes at Khirbet Qanafar)

2. Pastureland (PL)

2.1. Mid mountain secondary PL, sometimes with scattered trees (e.g. oaks, stone pine and/or small trees from the *Rosaceae* family) and/or shrubs.

Pasture Land at Ain Zibdeh

Pasture Land at Khirbet Qanafar

3. Scrubland (SL)

3.1. Limestone pioneer SL dominated by “garriga”-like (degraded maquis) low shrubs, namely Sarcopoterium spinosum and Calycotome villosa.

Scrub Land with Sarcopoterium spinosum and Calycotome villosa.

3.2. Sandstone pioneer SL dominated by “garriga”-like low shrubs, namely *Cistus creticus, Lavandula stoechas*.

3.3. "Maquis"-like SL, dominated by high shrubs and small-trees, including *Spartium junceum, Pistacia palaestina, Rhus coriaria*, among others.

Maquis-like SL with *Spartium junceum and Pistacia palaestina*

4. Forest land (FL)

4.1. Dense stone pine (P. pinea) agro-forestry FL
4.2. Open Stone pine (P. pinea) agro-forestry FL
4.3. Dense Q. calliprinos FL
4.4. Open Q. calliprinos FL
4.5. Dense mixed oak (Q. infectoria and Q. calliprinos) FL

Dense Oak spp. Forest. It is rather a maquis than real forest (forest trees are much taller).

4.6. Open mixed oak (Q. infectoria and Q. calliprinos) FL
4.7. Dense pine-oak (P. brutia, Q. calliprinos and Q. infectoria) FL
4.8. Open pine-oak (P. brutia, Q. calliprinos and Q. infectoria) FL
4.9. Riparian FL dominated by Alnus orientalis
4.10. Ammiq lake FL dominated by Fraxinus syriaca
4.11. Tree shelterbelt (e.g. Populus sp.) to protect agriculture land
4.12. Tree shelterbelt (e.g. Cupressus sp.) along roads and urban areas

Cypress Trees (To the left)

5. Rocky outcrops (RO)
5.1. Mid mountain RO with almost no vegetation
5.2. Mid mountain RO with scattered shrubs
5.3. Mid mountain RO with scattered trees and shrubs

6. Quarries (QA)
6.1. Limestone quarries
6.2. Sandstone quarries with unstable sandy soils

7. Water surface (WS)
7.1. Ammiq lake
7.2. Qaraoun artificial lake

Qaraoun Lake (Bordering eastern Aitanit)

7.3. Artificial mountain lakes

7.4. River courses

Litani River bordering the eastern borders of Khirbit Qanafar and Ain Zibdeh.

7.5. Water springs

8. Urban (UR)

8.1. Villages

Khirbet Qanafar village

Ain Zebdeh Village

Aitanit Village

8.2. Scattered rural buildings in the agriculture land

Scattered rural buildings in agricultural areas

8.3. Bare land due to soil excavation

Mountain- and Oro-Mediterranean Level

9. Pastureland (PL)

9.1. PL in high mountain dolines

9.2. Mountain summit PL with thorny dwarf shrubs, namely spp, sometimes with scattered trees (e.g. oaks, stone pine and/or small trees from the *Rosaceae* family) and/or shrubs.

9.3. High mountain secondary PL in between forestland, sometimes with scattered trees (e.g. oaks, stone pine and/or small trees from the *Rosaceae* family) and/or shrubs.

10. Scrubland (SL)

10.1. High mountain secondary SL in limestone substrates, including *Spartium junceum, Styrax officinalis, Rhus coriaria*, Prunus spp, among others.

11. Forest land (FL)

11.1. Old-growth natural cedar FL

11.2. Open natural cedar FL
11.3. Cedar plantation in terraces with dense cover and high trees
11.4. cedar Plantation in terraces with open cover and lower trees
11.5. Cedar plantation scarcely developed
11.6. Mixed natural oak (Q. brantii) and cedar FL
11.7. Dense Q brantii FL
11.8. Open Q brantii FL
11.9. Dense Q calliprinos FL
11.10. Open Q. calliprinos FL

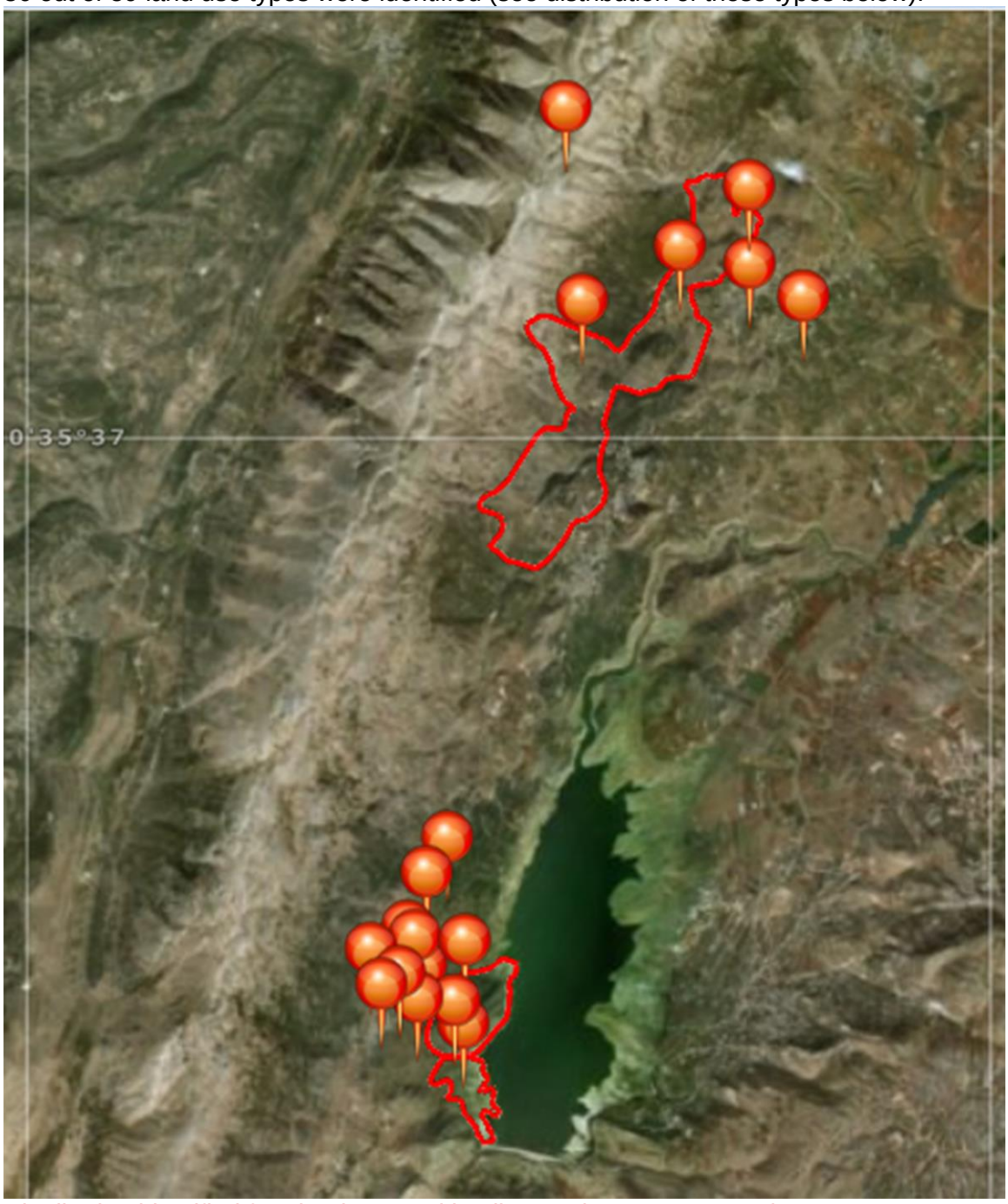
12. Rocky outcrops (RO)

12.1. High mountain with almost no vegetation

12.2. High mountain RO with scattered shrubs
12.3. High mountain RO with scattered trees and shrubs

III. DISCUSSION AND OBSERVATION

36 out of 59 land use types were identified (see distribution of these types below).



Distribution identified farmlands types (details are given on GIS map).

To the 36 types, we added an additional land use type consisting in plantation of woody shrubs (vineyards) on non-terraced slopes (Khirbet Q).

Plantation of vineyards on slopes without terraces. The constructed wall is not yet understood.

According to Elie Karam, the main shepherd of Khirbet Qanafar, his own herd counts 750 heads, chiefly goats that are mixed with very few sheep. For high altitude trips he takes with him only goats because of their capability of climbing. Depending on the weather and the season, most of the transhumance is altitudinal ranging from the Litany River in the east to the highest point of Khirbet Qanafar in the west. Horizontally, Elie moves between the northern Qanafar to the southern Ain Zibdeh, usually at middle altitude. His herd graze in woods, especially in summer time, it is said.
At Aitanit, grazing is apparently not allowed without rental agreement between the shepherd and the owner of the land. Below the national road passing throughout the three himas, grazing is allowed at Aitanit but limited to the southern hill looking over the Lake Qaraoun, whereas the northern hill is protected after the declaration of Aitanit a Hima, engineer Antoine Selwan of Aitanit municipality said. The difference between the northern and southern hills reveals the size of the damage caused by the overgrazing (this doesn't mean that sustainable grazing is rejected).

Northern hill to the left and Southern hill to the right (Aitanit) (see text).

From our discussion with a herdsman at the border Machghara/Aitanit, it appeared that he is leading a transhumance from Syria to Niha. His goats and sheep were climbing the Shouf Mountain at the point indicated on the map below and heading north on the western slopes of Niha. This observation by Ghassan Jaradi was confirmed by the member of Aitanit municipality.

The agricultural land uses in the three himas are distributed over lands above and below the main national road passing throughout these himas with the following approximate but proportionate percentages:

	Total area (based on LocaLiban)	% Agriculture area above road (based on map reading)	% Agriculture area below road (based on map reading)
Khirbet Qanafar	2143 ha	150 ha (7%)	983 ha (46%)
Ain Zibdeh	1040 ha	118 ha (11.35%)	90 ha (8.65%)
Aitanit	1381 ha	21 ha (1.52%)	418 ha (30.27%)

It is therefore normal that the agricultural fields below the national road are well represented as they benefit from the water of the litany River that runs below and parallel to the road. This is evident at Khirbet Qanafar and Aitanit. At Ain Zibdeh, the size of the area below the national road is relatively small, a reason for which the agriculture surface area is tending to be slightly greater above the national road.
In addition to the above it is worth noting that we have observed a certain number of terraces that were either abandoned or neglected (left without maintenance).

IV. SELECTION OF TYPES AND SUB-TYPES OF LAND USES

It has been noticed that the villagers count chiefly on three types of farmlands:

1. Productive agriculture terraced lands with orchards of Apple, Vineyard, and olive trees, mainly on terraces with traditional stone walls.
2. Productive agriculture flat lands with vineyards or vegetables or cereals.
3. Traditional pastoral system, involving both low mountain and high mountain pastures under a short-distance transhumance movement.

The second type is not related to cultural practices (terraces) but could be related to diversified biodiversity.

It has been also noticed that many terraced lands have been abandoned. Investigating into this matter, it appears that few of them have been abandoned for socio-economic reasons but the majority is abandoned due to the immigration of the owners and their families in response to the political tension in the country.

In order to select the types and subtypes of the farmlands, it is important to know the followings:

1- Importance of Terrace farming

a- The terrace farming helps to make farming on the sloppy hills or mountains where it is not too easy to farm without the help of graduated terrace constructed on the slopes. So, it is an important agricultural method which helps to cultivate on those sloppy region parts of the project's lands.

b- The absence of terracing may cause a huge unproductive, infertile area and loss of water. Terraces are able to transform the moistened and unused land into productive fields. And are also helpful in attending a great food security by increasing the productive area in maintaining soil nutrient content in the fields.

c- The terraces contribute to the maintenance of the biodiversity of the area vulnerable to soil erosion caused by the rainwater runoff.

Therefore, our duty is to enhance cultural practices (terrace farming) and provide support to restore the abandoned or provide maintenance to the damaged ones, whilst showing the positive impact of such type of farming on the biodiversity conservation.

2- Pasture lands

a- Traditional transhumant livestock management, based on a rotation and resting system, maintains high biodiversity values in terms of habitats, species and genetics.

b- Uncontrolled livestock grazing with no management of pasture land, and permanent livestock presence in the same places contribute to pasture degradation, habitat and species loss.

Types and sub-types that will be assessed, identifying specific sites/farmland units where monitoring activities will be implemented.
Most needed attention highlighted with yellow.

Major farmland type: Dry stone wall agriculture terraces with trees (ACS+SPNL)

Subtypes	**Parameters**						
	Crop variety/ ancientness	**Dry stone wall conservation**	**Crop-livestock integration**	**Irrigation**	**Soil management**	**Fertilizers**	**Pesticides**
I. Management practices linked to high biodiversity according to project hypothesis							
Mono-crop production of one tree species	Local variety and maintenance of old trees	Yes	Yes	To be defined: rainfed and/or drip irrigation	To be defined: no till and soil mulching; soil ploughing	Organic fertilizers	Integrated pest management
Multi-crop production of several tree species and/or shrubs and/or vegetables	Local variety and maintenance of old trees	Yes	Yes	To be defined: rainfed and/or drip irrigation	To be defined: no till and soil mulching; soil ploughing	Organic fertilizers	Integrated pest management
Restored pilot terraces with	New plants	Yes	Yes	To be defined: rainfe	To be defined: no till and soil	Organic fertilizers	Integrated pest management

multi-crop production including native edible trees, shrubs and herbs				d and/or drip irrigation	mulching; soil ploughing		
II. Management practices linked to biodiversity loss according to project hypothesis							
Mono-crop production of one tree (apple or olive or vine) under non-organic but intensive management	Productive variety; eradication of old trees	Yes	Chiefly no, otherwise terrains are rented to sheepherders after harvests	Yes. flooded irrigation	Soil ploughing	Non-organic fertilizers	Pesticides
Mono-crop production under intensive management (mainly apples)	To be defined: Productive variety; eradication of old trees	To be defined: traditional walls versus cemented walls	No	Yes. To be defined: flooded irrigation versus EIT	Soil ploughing	Non-organic fertilizers	Pesticides
Recently Abandoned terrace with no colonization of natural vegetation	To be defined: maintenance of previously cultivated trees or absence	To be defined: degree of maintenance or destruction of stone walls	To be defined: presence or absence of livestock	NA	NA	NA	NA
Mid-term abandon	Absence of	To be defined:	To be defined:	NA	NA	NA	NA

ed terrace with colonization of natural vegetation. The two mentioned genera are usually eaten by goat herds	maintenance of previously cultivated trees	degree of destruction of stone walls 65%	presence or absence of livestock				
Old abandoned terrace with woodland cover	To be defined: maintenance of previously cultivated trees or absence	To be defined: degree of maintenance or destruction of stone walls	To be defined: presence or absence of livestock	NA	NA	NA	NA

Major farmland type: Mountain Pastureland (ACS + SPNL)

Subtypes	**Parameters**						
	Pasture quality	**Rocky soil**	**vegetation types**	**Livestock type**	**Stocking rate**	**Grazing seasonality**	**Pasture management**
III. Management practices linked to high biodiversity according to project hypothesis							
Restored pilot pastures with rotation/resting livestock management (ACS, Shouf area)	Several pasture types with good representation of grass and legume species, and good cover	To be defined: % of soil cover by rocks	Mosaic structure with pasture, pasture with scattered trees and shrubs	To be defined: sheep and/or goat breeds	To be defined	To be defined	To be defined: none; temporary resting; seed sowing

Restored pilot pastures under hima system (SPNL, West Bekaa) At Aitanit (northern hill above Lake Qaraoun)	Several pasture types with good representation of grass and legume species, and good cover	To be defined: % of soil cover by rocks	Mosaic structure with pasture, pasture with scattered trees and shrubs	To be defined: sheep and/or goat breeds (both)	To be defined	To be defined	To be defined
High mountain SBR core zone area with absence of livestock	Several pasture types with good representation of grass and legume species, and good cover	To be defined: % of soil cover by rocks	Mosaic structure with pasture, pasture with scattered trees and shrubs	None	None	None	None
IV. Management practices linked to biodiversity loss according to project hypothesis							
Non-regulated livestock management in low mountain area	One pasture type with few palatable species and scarce cover	To be defined: % of soil cover by rocks	To be defined: Mosaic ~~versus mono-structure~~	To be defined: sheep and/or goat breeds (mainly goats)	To be defined	To be defined	To be defined
Non-regulated livestock management in high mountain area (outside the SBR, in an area with similar conditions)	One pasture type with few palatable species and scarce cover	To be defined: % of soil cover by rocks	To be defined: Mosaic versus mono-structure	To be defined: sheep and/or goat breeds	To be defined	To be defined	To be defined

High mountain area inside SBR core zone with absence of livestock	Several pasture types with good cover and poor representation of palatable grass and legume species	To be defined: % of soil cover by rocks	Mosaic structure with pasture, pasture with scattered trees and shrubs, shrubs and forest	NA	NA	NA	NA

Major farmland type: Semi-domesticated forest system (ACS)

Subtypes	**Parameters**						
	Forest canopy	**Forest structure**	**Forest species diversity**	**Tree management**	**Forest-livestock integration**	**NTFP collection**	**Forest stand fragmentation**
V. Management practices linked to high biodiversity according to project hypothesis							
Stone pine agro-forestry with multipurpose NTFP production	To be defined: open to close canopy	To be defined	To be defined	To be defined	To be defined	To be defined	No
Restored coppice oak woodland with multipurpose NTFP production	% of canopy cover after thinning	To be defined	To be defined	Thinning of tree stems in order to keep 3 stems per individual	Goat grazing after thinning	To be defined	No
VI. Management practices linked to biodiversity loss according to project hypothesis							
Abandoned coppice	Very dense canopy	To be defined	To be defined	No management	To be defined	To be defined	No

oak woodland							
Over-exploited stone pine forest for pine nut collection	To be defined: open to close canopy	To be defined	Low diversity	Mutilation of tree branches	To be defined	To be defined	Yes

The table above may be discussed and fine-tuned on the light of the above illustrated land uses found in the Himas of West Beqaa. Further visits by the experts will certainly contribute to improving this table and provide description to the habitats of its farming types and subtypes.

In addition to the above table, it will be of high interest to maintain and manage the dehasa-like area to the north of the northern hill of Aitanit and to have it seeded in order to provide forage plants to livestocks.

Dehasa-like area to the north of the northern hill of Aitanit.

V. SELECTION OF BIODIVERSITY INDICATORS FOR THE FARMLAND TYPES/CULTURAL PRACTICES THAT ARE THE AIM OF THIS PROJECT.

BIRDS

Around 10% of recent papers in the Journal of Applied Ecology have examined interactions between birds and agriculture. This statistic reflects the position of birds as both indicators and targets of agricultural change: their patterns of behaviour, distribution, seasonal phenology and demography track closely onto the spatial and temporal scales of agricultural intensification. All the papers propose management prescriptions for agricultural areas that blend the microscopic - for example, how to modify local land structure to benefit birds - and the macroscopic - for example, by suggested inputs into land-use policy. This interest in birds derives from the fact that they are beneficial since

they provide in addition to pollination an ecosystem service for pest removal and mitigation.

In Europe, many farmland bird species have decreased due to agricultural practices. If agricultural practice has reduced populations hitherto, then agricultural practice can restore the losses. Thus, from this strong inter-relation between agriculture and birds we can use bird data to develop biodiversity indicators for agriculture and farming.

Agriculture impacts on wild species in different ways. Farmed habitats are affected by agricultural intensification and abandonment, while conversion of other habitats to agriculture also impacts on biodiversity. A wealth of bird conservation data is available for the Himas of West Beqaa Valley, and offers opportunities to develop biodiversity indicators for agriculture. Birdlife believes that it is essential that biodiversity indicators cover trends in species populations as well as habitats. In this report, we propose three approaches to indicator development, using data on 1)important sites, 2) widespread and common species and 3) threatened species. The report presents information and examples that could form the basis of further indicator development work and identifies a series of actions that would aid the development of wild bird indicators for agriculture in the Himas of West Beqaa.

There is increasing interest in the use of bird data to indicate the effects of environmental change on biodiversity. Bird indicators are likely to form an important component of sets of indicators for biodiversity and habitats. Habitat indicators can be used to assess wider, "macro" level changes, while indicators for birds and other taxa can also be used to identify more subtle changes in biodiversity within habitats. By highlighting these changes, bird indicators can point to the need for more detailed research to identify the causes of change in populations of different species.

Bird indicators are sensitive to agricultural development and intensification, agricultural abandonment and impact of agriculture on habitats. This makes the bird indicators helpful to policy makers to identify priorities for policy action and help to monitor and communicate the impact of policy. Accordingly, bird indicators should be quantitative, simplifying information, policy relevant, scientifically credible, easily understood, realistic to collect and susceptible to analysis. In addition, indicators should:

- address all of the key issues of policy relevance, e.g. populations of species within agriculture, impact of agriculture on other species, effects on both widespread and threatened species;
- be representative of wider trends - single species trends may be informative, but there is a danger that they are unrepresentative and misleading. It is preferable to use a wider group of species;
- present time series data to reveal medium term trends;
- utilize available data, without being excessively data-driven. There is a need to strike an appropriate balance between using what data we have and improving monitoring systems to develop data for use in future indicators.

Trends in wild farmland bird species are a good indicator of agricultural practices and the effectiveness of agri-environment policy. However, Indicators do not make much sense without reference points against which the significance of change can be assessed. This includes the baseline or starting point against which change can be measured. Indicators can also use thresholds to assess changes in species status (e.g. measuring changes in status from secure to threatened). From several research studies, the usefulness for the development and assessment of agri-environment indicators is best within the framework of "driving force-state-response". For example, for biodiversity, it is essential to develop indicators to assess trends in wildlife populations (the state), as well as understanding the driving forces that affect farmland wildlife (e.g. pesticide use, water use, grassland management, length of hedgerows), and responses (e.g. agri- environment schemes, farm biodiversity plans promoting

sustainable agriculture).

VI. THE INDICATORS

Indicator type	Indicator	Description
State	Habitat	Change in cover of habitat types (those relevant to agriculture include highly improved re-seeded grassland, arable land, perennial crops/orchards/groves, ruderal land, steppe/dry calcareous grassland, meosphile grassland etc.)
	Key bird populations	Trends in population sizes of: - globally threatened species using agricultural habitats *Streptopelia turtur* (VU) (Turtle Dove) and *Serinus syriacus* (VU) (Syrian Serin) - Common and widespread species significantly using agricultural habitats in West Beqaa: 1. *Alectoris chukar* R 2. *Tyto alba* R 3. *Calandrella brachydactyla* SB 4. *Carduelis cannabina* R (above 1200 m a.s.l) 5. *Emberiza melanocephala* SB 6. *Falco tinnunculus* R 7. *Galerida cristata* R 8. *Hirundo rustica* SB 9. *Lanius collurio* SB 10. *Melanocorypha calandra* R 11. *Miliaria calandra* SB 12. *Oenanthe hispanica* SB 13. *Passer domesticus* R 14. *Petronia petronia* R 15. *Sylvia communis* SB 16. *Upupa epops* R 17. *Clamator glandarius* R 18. *Sylvia atricapilla* R 19. *Pycnonotus xanthpygos* R (below 1000 m a.s.l) 20. *Corvus cornix* R
	Land-use	Change in cover of land-use types
Pressure	Impacts	Change in impact (importance score − high, medium, low) of "X" classes of impact to IBAs including agricultural intensification/ expansion,

		abandonment/reduction in land management, groundwater abstraction, shifting agriculture etc.
Response	Management plan	Change presence of management plan. Potential to extend to include implementation of actions in plan related to agricultural practices.

Changes in trends of a set of farmland common birds and/ or farmland globally threatened bird species will reflect positive or negative changes in management of farmlands and/or pasture lands.

Monitoring will primarily use the point count method and/or the transect combined with point counts.

The bird expert may use an index for bird indicators or models of their distribution as a tool for their monitoring.

Monitoring should be during the breeding season as birds during passage are highly variable and often not related to their own habitat. In winter we may see more birds on farmland than in summer. This is partially because birds aggregate into large flocks in the winter, which are more noticeable than when they are scattered across the farmland. Also, many species move to Lebanon from northern countries to avoid the harsher winter weather on the continent.
Numbers seen on farmland in the winter are therefore very variable, often more a reflection on breeding success outside of the country. Breeding population counts are a much more reliable means of monitoring population changes.

VII. MONITORING PROTOCOL FOR BIRD INDICATORS IN FARMLANDS OF WEST BEQAA

INTRODUCTION

Birds have been fragmentally studied and monitored in Lebanon. Nowadays, the number of bird-watchers and bird-lovers is increasing. Examples of the studies include the Breeding Bird Surveys over all the country (Ramadan-Jaradi *et al.* 1997 to 2018), breeding birds monitoring in Anjar and Palm Islands, and monitoring of illegally killed birds in Anjar, Khirbet Qanafar, Ain Zibdeh, Aitanit and Qaraoun Himas. All of these monitoring efforts provide long-term data on the status and trends in avian abundance, density, and species richness, data that have proven to be extremely valuable in detecting long-term regional or national declines in many songbirds and game birds and in defining conservation actions. The study of birds that are attached to farmlands has a short history. Yet this moderate body of research includes no long-term monitoring programs, based on standardized methodologies, like the programs in Europe and North America. While monitoring has been conducted recently in Lebanon to assess the impacts of disturbance (hunting) on avian community composition or specific population parameters, the results of these efforts are difficult to interpret because the monitoring activities didn't yield comparable data yet and because impact assessments are difficult to conduct and interpret in the challenging absence of baseline information. Yet establishing a long-term bird monitoring program in the trends of farmlands is well worth the trouble. Birds are the most numerous species class of terrestrial vertebrates, and they are common and diverse throughout the country. All Lebanese habitats contain both generalist and specialist bird species, and thus birds are useful for monitoring both local and regional trends in a variety of community and population parameters.

The SPNL has established the present standardized monitoring protocol for farmland birds. At each of the selected land use type, data will be gathered from plots using this protocol at multiple monitoring sites. These data will provide a baseline of trends in agriculture lands and pasture lands and will provide number of individuals.

DESCRIPTION OF THE OBJECTIVES OF THE PROTOCOL

The overall objective of this protocol is to enhance and restore the wealth of the biodiversity and cultural heritage of the landscape.

The two primary objectives of the monitoring protocol of indicator birds at west Beqaa Himas are: (1) to follow up the changes in the agro-pastoral land use at various level (macro to micro) and (2) to track trends in the relative abundance of farm bird species that reflect the quality of the management of farmlands, and (3) to promote cultural practices that are beneficial to farmers and biodiversity. Another, but secondary objective

of the protocol consists of assisting concerned authorities about the policy for agri-environment.

INFORMATION ON THE CONTEXT OF THE THREATS FACING AGRICULTURE IN WEST BEQAA

West Beqaa agriculture, which offers fertile land, landscaped terraces, and fresh and healthy produce, faces several challenges in recent years. Improper agricultural practices leading to soil erosion and impoverishment, depletion of underground water resources, water pollution and health impacts from inappropriate use of pesticides and fertilizers, and environmental pollution from haphazard dumping of slaughter waste and animal farms are the main problems of this sector. Agriculture is also diminishing to rampant urbanization. The government's policies appear to be targeting the increase in the availability of water irrigation and controlling the use of pesticides, with no or little investment or incentives for water- and soil-conserving irrigation techniques. The private sector is gradually taking advantage of new but small-scale opportunities offered by organic farming and high-value agricultural produce. Yet, some of the farmers are still unaware of 1) the importance of cultural practices in protecting the soil, 2) the importance of seeding and managing grazing open areas to create pasture lands, the importance of creating hedgerows, wind breaking trees and buffer zones to help them increasing and/ or conserving the biodiversity that will help them in organic and healthy farming.

DATA COLLECTION & STAKEHOLDERS (HOMAT AL HIMA)

The bird expert (sometimes with his occasional accompanying colleagues) may increasingly rely on the Homat AlHima for collecting data about birds of farmlands and their management. The Homat AlHima are those people- mainly young- that have sufficient energy to cover study areas within a short time and with motivation. They are from the local communities and were previously selected by SPNL after a series of meetings and trainings followed by evaluation of skills and qualifications.

Homat Al Hima have been requested to collect data on regular basis from their villages and the immediate surrounding areas. This request is based on their love to birds, their access to the local hunting groups, including their parents and their community, and their desire to feedback to SPNL and compete with others from other villages. In return, SPNL provides those who are feeding back with certificates of recognition as an incentive to maintain their motivation at a high level and to mobilize them to perform short and mid-term monitoring of birds.

In order to maintain Homat AlHima’s high motivation level, SPNL organizes conferences, seminars and workshops where staff meets with the Homat AlHima to discuss positive and negative matters, focusing on the importance of Homat AlHima’s findings; to eat together as this will go a long way in motivating and encouraging Homat AlHima and to have fun together. The latter is crucial since fun is considered as stress buster, breaking ice between paid staff and volunteers and finally a source of mobilization and motivation.

In addition to the above, SPNL doesn't neglect the data from West Beqaa through information shared by birdwatchers on BirdtalkLebanon website which is an email group. SPNL partnership with Sayd Magazine which addresses hunters in Lebanon is another resource for information directly from hunters.
All these resources collectively help in providing an overview of the ornithological scene from West Beqaa. What left is to train the Homat Al Himas on how to monitor the breeding common and widespread bird populations in the selected land use farmland types and sub-types.
Other stakeholders could be hunting associations, farmers, shepherds, municipalities and the Ministry of Environment.
SPNL is not neglecting volunteers and students as another type of information source. Some students will work for SPNL to add the experience to their resume when they graduate. Other students get college credit. Their mobilization and motivation are under-planning by SPNL, in close cooperation with municipalities and the Homat AlHima.
This monitoring protocol is developed, based on the BirdLife International guidelines, after a series of meetings and discussions with stakeholders.

METHODOLOGY

The selection of monitoring methods for this protocol is based on a combination of transect and point count monitoring methods, conducted mainly from mid-February (for owls) to mid-June (for confirmation), throughout March, April and May. Other methods could be used occasionally to confirm the distribution of pairs and individuals: Vantage points are good for observing the number of individuals or counting the number of nests found.
At Khirbet Qanafar, Ain Zibdeh and Aitanit where the area of farms is large, it is difficult to study the illegal killing on its entire surface area through census as this will consume unwanted time and efforts. Instead, random sample plots or stations are surveyed. As the sampling is conducted within areas that are classified as farmland type or sub-type, the sampling is called stratified. Therefore, the sampling covering wider range of habitats will tend to ensure better coverage of monitored areas and more trusted results.

Larger number of samples taken leads to more precise results and less statistical errors. But there is a statistical tool that shows the quality of the count and prevents the observer from undertaking a large number of samples. Furthermore, the number of samples may also depend on human resources and equipment available.
Line transect can be easily walked up by the surveyor who is scanning both sides of the transect.
Thus, the Point count used is the 20-minute point count (Blondel 1975; Blondel *et al.*, 1981). In the combined transect-Point count, the counts will be along the transect and spaced 100 meters from each other.

The species of farmlands and the number of their individuals can easily be obtained through the use of binoculars, appropriate cameras and direct contact with farmers and sheepherders.

Briefly, the use of the combined method doesn't only allow estimates of species richness but also the number of individuals of each species observed.

SURVEY DESIGN

The appropriate survey design should satisfy the objectives of the monitoring process and should preferably be tailored with the stakeholders that are in charge of collecting information about the farmland birds. The design itself aims at providing effectiveness and strength in data collection and ensuring information reliability so that the image of observed birds is adequately captured. The same design is meant to create a balance between all elements of monitoring including the logistical and financial constraints. However, whatever monitoring programme emerges from this balance should use consistent methodologies that enable direct comparisons of data between years and between different type or sub-types of farmlands in order to allow calculation of trends over the time. Financially, the cost of transportation for monitoring conducted by people from local community is normally reduced compared to the cost of transportation of foreigners coming to assist in monitoring bird indicators.

This monitoring protocol is built to respond to the following questions:

- ✓ **What is the main objective of the monitoring protocol and what are the immediate objectives?**

✓ The overall objective of this protocol is to enhance and restore the wealth of the biodiversity and cultural heritage of the landscape. ✓ The two primary objectives of the monitoring protocol of indicator birds at west Beqaa Himas are: (1) to follow up the changes in the agro-pastoral land use at various level (macro to micro) and (2) to track trends in the relative abundance of farm bird species that reflect the quality of the management of farmlands, and (3) to promote cultural practices that are beneficial to farmers and biodiversity. Another, but secondary objective of the protocol consists of assisting concerned authorities about the policy for agri-environment.

- ✓ **How to reach the set objectives (data required to fulfil the objectives)?**

Through implementation of some appropriate actions, activities and tasks such as application of proper methodologies, selection of sampling tools, identification of stakeholders, use of methodologies allowing comparable data, use of strategies to approach poachers, management of flow of information, etc. Due to the nature of terrain at West Beqaa where some areas couldn't be penetrated or climbed or even directly traversed, we added to the stratified and random sampling through transects and point counts a strategy consisting of hearing the calls and songs of the nesting birds and identifying their species, especially at sites of high altitudes where the goats (but not sheep) can climb.

- ✓ **How many species are seen by plot?**

The number of species should be relying on frequent identification and recording of species.

- ✓ **How many individuals per species are seen?**

Number of individuals per each identified species should be recorded preferably in a database programme. One singing male in the same place at different visits or one female carrying food or nesting material equal one couple (pair).

- ✓ **What are the methods used for recording the bird-indicators?**

Birds could be observed from along a transect with point counts or with point counts alone (according to the terrain). Where the area is large, stratified sampling or random sampling can be used.

- ✓ **How the change in trends of farmlands is from year to year?**

It is important to know how is the trend from spring to spring. This also involves the distribution of species/individuals/period of time or dates (seasons) over an area of different landscapes.

- ✓ **Are the conservation efforts successful?**

The successfulness of the conservation efforts could be measured by the equal distribution of the individuals of various farmland species, the increase of the number of individuals/species. The trend if compared to the doses of awareness about sustainable agriculture and grazing could be useful in answering the question.

- ✓ **Who will be engaged in gathering the needed information**

Surveyors whether volunteers or paid staff or students should be indigenous to the same area in which the land use types or subtypes are surveyed.

In order to simplify the required information, a **monitoring sheet** is given below (Figure 1).

MONITORING SHEET **Name of the observer:**	***Name of the land use type*** if any or ***Name of the plot*** (station): ……. ……. …….	***GPS coordinates*** …… …… ……	***Circle the type of location:*** Corridor Yes No Bottleneck Yes No Terrace Yes No Slope Yes No Flat land Yes No Others: ……..
Circle Method used: Point Count Transect	***Time***: from to: ***Temperature:***	***Wind speed:*** Less than 5 km/h More than 5 km/h	***Clouds:*** Mist: Fog: ***No clouds:*** Sunny: ……:
Farmland Species recorded	***English or Latin name:*** **…….** ***Local name optional:*** **……..**	***# of individuals:*** # of nesting pairs:	***Remarks*** *Hedgerow, windbreak trees* *Buffer zone* *Freshwater*

			……………..
	English or Latin name: **……………………………..** ***Local name optional:*** **………………………………..**	***# of individuals:*** # of nesting pairs:	***Remarks*** *Hedgerow, windbreak trees* *Buffer zone* *Freshwater* *……………..*
	English or Latin name: **……………………………..** ***Local name optional:*** **………………………………..**	***# of individuals:*** # of nesting pairs:	***Remarks*** *Hedgerow, windbreak trees* *Buffer zone* *Freshwater* *……………..*
	English or Latin name: **……………………………..** ***Local name optional:*** **………………………………..**	***# of individuals:*** # of nesting pairs:	***Remarks*** *Hedgerow, windbreak trees* *Buffer zone* *Freshwater* *……………..*
	English or Latin name: **……………………………..** ***Local name optional:*** **………………………………..**	***# of individuals:*** # of nesting pairs:	***Remarks*** *Hedgerow, windbreak trees* *Buffer zone* *Freshwater* *……………..*
Habitat	***Type of Habitat:*** *Please describe**: scrubland, woodland, meadow, orchards, cultivated with cereals (species), vegetables (species), etc.*** ***Quality of terraces if any:*** ***Cover of vegetation: Please** estimate:*		
Additional Remarks			

PHOTO AND MAPS OF THE MONITORING AREA:

Each plot should be photographed and given GPS coordinates

Each plot should receive a minimum of three visits: one in the third of March for breeding sedentary species, one in the second half of April for breeding summer visitors and one in June for confirmation of results.

Mapping the records on a GIS Map is preferred.

FARMLANDS SURVEY PROTOCOL

For the security of the surveyors, at least two observers should visit each of the sample point or transect and conduct a thorough survey, recording all direct or indirect evidence of occurrence and also the main types of habitat within the radius of the point count. The time taken to survey each square is also recorded.
For health and safety reasons (avoidance of possible confrontation with poachers), the surveyors should limit their field trip to day time, mainly between 07.00 and 10.00 AM and 4.00 to 6.00 PM. Each sample plot is surveyed preferably thrice each breeding season (see above).

MONITORING OUTSIDE THE RANDOMLY SELECTED PLOTS

Opportunistic observations are also made at extra sites outside the sampled plots in order to gather further evidence of presence/absence of other species and their role in the site in which they are recorded. For an expert such records may enrich the information obtained or may assist in analyzing the monitoring records (A species may be breeding in a plot but collecting for example nesting material from outside the plot).

ANALYSES OF DATA FLOW

Detecting trends in population level

The data collected from the same place will be compared from year to year.
The analyses will consider:

a) The total number of species recorded (richness).
b) Methods used in gathering the data.
c) Average number of species per visit.
d) Number of individuals per species per season.
e) Number of individuals per species/plot/season.
f) Comparing data from year to year.
g) Testing significance of compared averages/means.
h) Analyse reasons of differences found throughout the season (changes in crops, intended or un-intended poaching by sheepherders, illegal hunting, et.

VIII. MONITORING OF SYRIAN SERIN

Syrian Serin *Serinus syriacus*

Status: Summer breeding (SB), Passage migrant (pm), rare winter visitor).
Very common migrant breeder from early March–mid-August in Anjar, rocky montane areas including high eastern slopes of Shouf Biosphere Reserve when the species moves upward for a second or third brood. Mainly recorded in open cedar, pine and fir forests. During post-breeding dispersal, commonly found above the tree-line. Some migrants from outside Lebanon probably arrive in early October–late March.

National monitoring
National survey is currently undertaken by Ghassan RAMADAN-JARADI

Population and distribution
Reported from Aammiq, Ainata North, Ain el Dardara, Ain Tourine, Ain Zhalta, Ain Zibdeh, Aitanit, Afqa, Arz el Shouf, Azour, Baalbek, Barouk, Bcharre, Chambouq, Chwayya, Dounniyeh, Ehden, Fneideq, Hadath el Jibbeh, Hasbani, Hermel, Jabal Rihane, Joub Jannine, Kefraya South, Kfar Hamam, Kfarhouna, Khirbet Qanafar, Maasser el Shouf, Mrah Sabaya, Qammouha and Tannourine. First recorded and first breeding confirmed, at cedars, by Tristram (1864) and first reconfirmed breeding for over 22 years by Ramadan-Jaradi & Ramadan-Jaradi (1997).

Ecology

Males court females with a song display, and each pair builds a nest in an evergreen tree (preferably Cypress tree) in March April. Four pale blue, glossy eggs are laid in April and May, and the female incubates these for 12–14 days. The young fledge after just 14–16 days and the parents then move up to around 1,800 metres in July and August to produce a second clutch. When conditions allow, the pair can produce three broods. In southwest Jordan, most pairs apparently breed only once per year as suitable breeding habitat does not exist at higher elevations. At Anjar, they may have up to three broods without moving up to a higher altitude (Ramadan Jaradi, G. verb. Comm.).

Breeding season survey -population

The method used is either the linear transect or the point count method (Blondel et al. 1981). During the breeding season, the surveyor may record all individuals seen or heard on both side of the transect within a limited but fixed period of time. If the farm is limited by a public road, it is possible to survey areas by car. At each stopping place, turn off the engine and get out of the car. Spend at least 10-20 minutes listening. If a Turtle Dove happens to be near the road, it will stop calling when the car engine is turned on. If your

car windows are down you will hear this and should wait to confirm the presence of the bird.

The surveyor may prefer to select randomly sampling points among evergreen conifers, usually used as wind breakers at West Beqaa farms. The observer records for example any Syrian Serin seen or heard within a circle of 50 meters radius. Records of males calling, females carrying food materials point to pairs. The breeding female remains in the same place until the fledglings have left the nest. Observation of individuals without signs or evidence of breeding points to single birds.

Information required

- Number of proven, probable and possible breeding pairs
- Number of the individuals making the population of the Syrian Serin in the surveyed farm.
- Map of the survey area boundary.
- GPS coordinates for each nest or individual located.

Number and timing of visits

At least three visits from late March to the mid of July.

Time of day

Early morning (in the hours after sunrise) and/or evening (hours before sunset).

Weather constraints

Avoid cold, wet, foggy and windy conditions.

Sites/areas to visit

Habitats with water, weeds, and evergreen conifer trees.

Equipment

- 1:10,000 map or laptop with GIS map program
- Binoculars preferably 42 x 8
- Camera with lens 300 or more.
- Field guide book or Smartphone bird guidebook app.

Safety reminders

It is very important to gain access permission to the farm, even though this may prove quite difficult. Abandoned houses can be particularly dangerous, so please abide by any safety advice given by the landowner, eg. wear a hard hat or stay away from unsafe buildings.

Disturbance

The method involves minimal disturbance to nesting birds. Do not disturb Turtle Doves and Syrian Serins while counting. It is not necessary to get closer than 100 m to pinpoint a male's calling position. If he stops calling you may be too close - stand still and make no noise until he starts singing again, then walk slowly away. Avoid flushing females by using field edges and

paths to pinpoint bird positions. Never use playback of tapes, etc, to try to uncover a Turtle Dove or Syrian Serin.

Methods

Map the boundary of the survey area. The survey route may depend on where access permission has been granted and where it is safe to survey. Taking these factors into consideration, walk a predetermined route through the area which allows you to approach to within 100 m of each accessible spot. Mark the route on to the map and use the same route every time, even between years. Take a new map on each visit, and clearly mark each map with the date. Alternate the direction of the route taken on each subsequent visit, so that you are not always starting and ending at the same place. Walk slowly, taking time to stop and listen for singing birds or to observe any suspected sightings through binoculars. Whenever a Syrian Serin is seen or heard, follow this up immediately. This will inevitably mean deviating from the original survey route for a short time.

Males prefer to sing from a prominent position on a tree or electric line - sometimes a rooftop. The far-carrying (if scratchy) song is the best auditory cue. Map the location and behavior of the bird(s) and then continue on the survey route.

From all the individual visit maps, create a summary map of registrations and use the following criteria to assess the number of proven, probable and possible breeding Syrian Serin that were present. Report these along with the summary map of registrations.

Breeding is *proved* if:

- a nest or used nest is found
- a nest with young is seen or heard
- recently fledged young are located
- adults are seen entering or leaving a nest-site, or an adult is seen incubating
- an adult is seen carrying a faecal sac or food for young.

Breeding is *probable* if:

- a pair of birds is seen in suitable nesting habitat during the breeding season
- a male is heard singing at the same place on two or more occasions,
- courtship and/or display are seen,
- a bird is seen visiting a probable nest-site,
- birds exhibit agitated behavior or give alarm-calls
- nest-building is observed.

Breeding is possible if'.

- birds are seen in the breeding season
- birds are seen in possible nesting habitat during the breeding season
- a singing male is heard once during the breeding season.

IX. MONITORING OF TURTLE DOVE

Turtle Dove *Streptopelia turtur*

Phenological status

Summer breeding **(SB), sb, PM:** Not uncommon migrant breeder (April–August) in montane areas up to 1800m asl in the Beqaa Valley (mainly Hermel and Qaa and the slopes above the valley), and probably on Palm Islands. Common passage migrant across most of the country in late March–early June (peak early April–mid-May) and early August–late November (peak late August–late September). First recorded in 1877 by Van Dyck (Kumerloeve 1960a, 1962) and first breeding confirmed by Kumerloeve (1962).

National monitoring

National survey is currently undertaken by Ghassan RAMADAN-JARADI

Population and distribution

During migration, it is reported from most areas in Lebanon. In the breeding season, it frequents mainly the middle mountain, the eastern slopes of Shouf-Barouk area, Hermel, Qaa and probably elsewhere.

Ecology

It is a bird of open rather than dense woodlands, and frequently feeds on the ground. It will occasionally nest in large gardens, but is usually extremely timid, probably due to the heavy hunting pressure it faces. Turtle Doves require tall, overgrown bushes for nesting and short weed-rich areas for feeding, but agricultural intensification has markedly reduced the availability and suitability of these habitats. Over the last 40 years, Turtle Doves have switched from foraging in 'natural habitats' to those created by humans, and their diet is now primarily seeds from cultivated plants.

Breeding season survey -population

The method used is either the linear transect or the point count method (Blondel et al. 1981). During the breeding season, the surveyor may record all individuals seen or heard on both side of the transect within a limited period of time. The surveyor may prefer to select randomly sampling points within cultivated fields and their nearby hedgerows of tall shrubby plants. The observer records any Turtle Dove seen or heard within a circle of 50 meters radius. Records of males calling, females carrying food point to pairs. The breeding pairs remain in the same place until the fledglings have left the nest. Observation of individuals without signs or evidence of breeding points usually to single birds.

Information required

- Number of proven, probable and possible breeding pairs
- Number of the individuals forming the population of the Turtle Dove in the surveyed farmlands.
- Map of the survey area boundary.
- GPS coordinates for each nest and individual located.

Number and timing of visits

At least three visits from mid-April to the mid-July.

Time of day

Early morning (in the hours after sunrise) and/or evening (hours before sunset).

Weather constraints

Avoid cold, wet, foggy and windy conditions.

Sites/areas to visit

Habitats with water, heavy weeds, and cultivated areas.

Equipment

- 1:10,000 map or laptop with GIS map program
- Binoculars preferably 42 x 8
- Camera with lens 300 or more.
- Field guide book or Smartphone bird guidebook app.

Safety reminders

It is very important to gain access permission to the farm, even though this may prove quite difficult. Abandoned houses can be particularly dangerous, so please abide by any safety advice given by the landowner, eg wear a hard hat or stay away from unsafe buildings.

Disturbance

The method involves minimal disturbance to nesting birds.

Methods

Map the boundary of the survey area. The survey route may depend on where access permission has been granted and where it is safe to survey. Taking these factors into consideration, walk a predetermined route through the area which allows you to approach to within 100 m of each accessible spot. Mark the route on the map and use the same route every time, even between years. Take a new map on each visit, and clearly mark each map with the date and location. Alternate the direction of the route taken on each subsequent visit, so that you are not always starting and ending at the same place. Walk slowly, taking time to stop and listen for calling Turtle Doves or to observe any suspected sightings through binoculars. Whenever a Turtle dove is seen or heard, follow this up immediately. This will inevitably mean deviating from the original survey route for a short time.

Males prefer to call from a tree or in the wood. The far-carrying call is the best auditory cue. Map the location and behavior of the bird(s) and then continue on the survey route.

From all the individual visit maps, create a summary map of registrations and use the following criteria to assess the number of proven, probable and possible breeding Turtle Dove that were present. Report these along with the summary map of registrations.

Breeding is *proved* if:

- a nest or used nest is found
- a nest with young is seen or heard
- recently fledged young are located
- adults are seen entering or leaving a nest-site, or an adult is seen incubating
- an adult is seen carrying a faecal sac or food for young.

Breeding is *probable* if:

- a pair of birds is seen in suitable nesting habitat during the breeding season
- a male is heard singing at the same place on two or more occasions,
- courtship and/or display are seen,
- a bird is seen visiting a probable nest-site,
- birds exhibit agitated behavior or give alarm-calls
- nest-building is observed.

Breeding is possible if'.

- birds are seen in the breeding season
- birds are seen in possible nesting habitat during the breeding season
- a singing male is heard once during the breeding season.

N.B. The nuptial flight, high and circling with light undulations; it is accompanied by the whip-crack of the downward flicked wings. The arrival in spring is heralded by its purring song, a rather deep, vibrating “turrr, turrr”.

X. FURTHER READING

Ahnström, J., Höckert, J., Bergeå, H. L., Francis, C. A., Skelton, P., & Hallgren, L. (2009). Farmers and nature conservation: What is known about attitudes, context factors and actions affecting conservation? Renewable Agriculture and Food Systems, 24(1), 38–47.

Atkinson, P. W., Fuller, R. J., Vickery, J. A., Conway, G. J., Tallowin, J. R. B., Smith, R. E. N., et al. (2005). Influence of agricultural management, sward structure and food resources on grassland field use by birds in lowland England. Journal of Applied Ecology, 42(5), 932–942.

Báldi, A., & Batáry, P. (2011). Spatial heterogeneity and farmland birds: different perspectives in Western and Eastern Europe. Ibis, 153(4), 875– 876.

Bengtsson, Janne, Ahnström, J., & Weibull, A.-C. (2005). The effects of organic agriculture on biodiversity and abundance: a meta-analysis. Journal of Applied Ecology, 42(2), 261–269.

Burton, R. J. F., & Paragahawewa, U. H. (2011). Creating culturally sustainable agri-environmental schemes. Journal of Rural Studies, 27(1), 95–104.

Chamberlain, D., Fuller, R., Bunce, R., Duckworth, J., & Shrubb, M. (2000). Changes in the abundance of farmland birds in relation to the timing of agricultural intensification in England and Wales. Journal of Applied Ecology, 37(5), 771–788.

Corti, M., Moranda, G., and Agostini, S. (2010). Indicators for Alpine Pastures Multifunctional Use. The Case of Estates of the Regional Agricultural and Forestry Services Board of Lombardy. *Ital. J. Agron. / Riv. Agron., 2010, 5:13-18*

de Snoo, G. R., Herzon, I., Staats, H., Burton, R. J. F., Schindler, S., van Dijk, J., et al. (2012). Toward effective nature conservation on farmland: making farmers matter. Conservation Letters, 6(1), 66–72.

Donald, P. F., Green, R. E., & Heath, M. F. (2001). Agricultural intensification and the collapse of Europe's farmland bird populations. Proceedings of the Royal Society B: Biological Sciences, 268(1462), 25–29.

Douglas, D. J. T., Vickery, J. A., & Benton, T. G. (2009). Improving the value of field margins as foraging habitat for farmland birds. Journal of Applied Ecology, 46(2), 353–362.

Eggers, S., Unell, M., & Pärt, T. (2011). Autumn-sowing of cereals reduces breeding bird numbers in a heterogeneous agricultural landscape. Biological Conservation, 144(3), 1137–1144.

Genghini, M., Gellini, S., and Gustin, M. (2005). Organic and integrated agriculture: the effects on bird communities in orchard farms in northern Italy. Biodiversity and Conservation (2006) 15:3077–3094. DOI 10.1007/s10531-005-5400-2

Gil-Tena, A., De Cáceres, M., Ernoult, A., Butet, A., Brotons, L., & Burel, F. (2015). Agricultural landscape composition as a driver of farmland bird diversity in Brittany (NW France). Agriculture, Ecosystems and Environment, 205, 79–89.

Gottschalk, T. K., Dittrich, R., Diekötter, T., Sheridan, P., Wolters, V., & Ekschmitt, K. (2010). Modelling land-use sustainability using farmland birds as indicators. Ecological Indicators, 10(1), 15–23.

Gregory, R. and Strien A. (2010). Wild bird indicators: using composite population trends of birds as measures of environmental health. Ornithol Sci 9: 3–22.

Holland, J. M., Hutchison, M. A. S., Smith, B., & Aebischer, N. J. (2006). A review of invertebrates and seed-bearing plants as food for farmland birds in Europe. Annals of Applied Biology, 148(1), 49–71.

Neely, N., and Batello, C. (2011). Integrated Pastoral and Agro-Silvo-Pastoral Systems in the drylands. https://drylandsforum.files.wordpress.com/2011/06/constanceneelyadw-june2011-neely5.pdf

Newton, I. (2004). The recent declines of farmland bird populations in Britain: an appraisal of causal factors and conservation actions. Ibis, 146(4), 579– 600.

OECD. (2001). Agriculture and Biodiversity: Developing Indicators for Policy Analysis Proceedings From an OECD Expert Meeting Zurich, Switzerland, November 2001

Elena Ojea, E., Nunes, P. and Loureiro, M. (2010). Mapping Biodiversity Indicators and Assessing Biodiversity Values in Global Forests. Environ Resource Econ (2010) 47:329–347. DOI 10.1007/s10640-010-9381-6

Perlut, N. G., Strong, A. M., Donovan, T. M., & Buckley, N. J. (2006). Grassland songbirds in a dynamic management landscape: behavioral responses and management strategies. Ecological Applications, 16(6), 2235–2247.

Santana, J., Reino, L., Stoate, C., Moreira, F., Ribeiro, P.F., Santos, J.L., Rotenberry, J.T., & Beja, P. (2017). Combined effects of landscape composition and heterogeneity on farmland avian diversity. Ecology and Evolution, 7: 1212-1223.

Santangeli, A., Arroyo, B. E., Millon, A., & Bretagnolle, V. (2015). Identifying effective actions to guide volunteer-based and nationwide conservation efforts for a ground-nesting farmland bird. Journal of Applied Ecology, 1– 10.

Shrubb, M. (1970) Birds and Farming Today, Bird Study, 17:2, 123-144, DOI: 10.1080/00063657009476265
To link to this article: https://doi.org/10.1080/00063657009476265

Siriwardena, G. M., Cooke, I. R., & Sutherland, W. J. (2012). Landscape, cropping and field boundary influences on bird abundance. Ecography, 35(2), 162–173.