

Wildlife Image Processing & Semantic Search System

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Agenda

* Why This Project

* The Hummingbird

* Architecture

* Demo

* Q&A

The screenshot shows a web-based application for wildlife image processing. On the left is a sidebar menu with links to Home, Ingestion Pipeline, Validation, Species Detection, Analysis (Analysis Explorer, Exploration / Search), Tools (One-Off Species Scraper, Database & File Clean-up, Geocode & Update Image Location, Regenerate Image Embeddings, Regenerate Text Embeddings), Appendix (Project Overview, Complete Wildlife Image Processing System, References), View less, and Sections. The main content area has a header "Home" with a paw print icon and "Wildlife Image Processing & Semantic Search System". Below the header is a descriptive text about the project's purpose. Three images are displayed: a Brown Bear, an American Bison, and an Owl. Each image has a caption and a confidence score.

| Species | Confidence | Classification Details |
|----------------|------------|--|
| Brown Bear | 0.738 | mammalia, carnivora, ursidae, ursus, arctos, brown bear |
| American Bison | 0.9952 | mammalia, cetartiodactyla, bovidae, bison, bison, None, american bison |
| Owl | 0.322 | aves, strigiformes, owl |

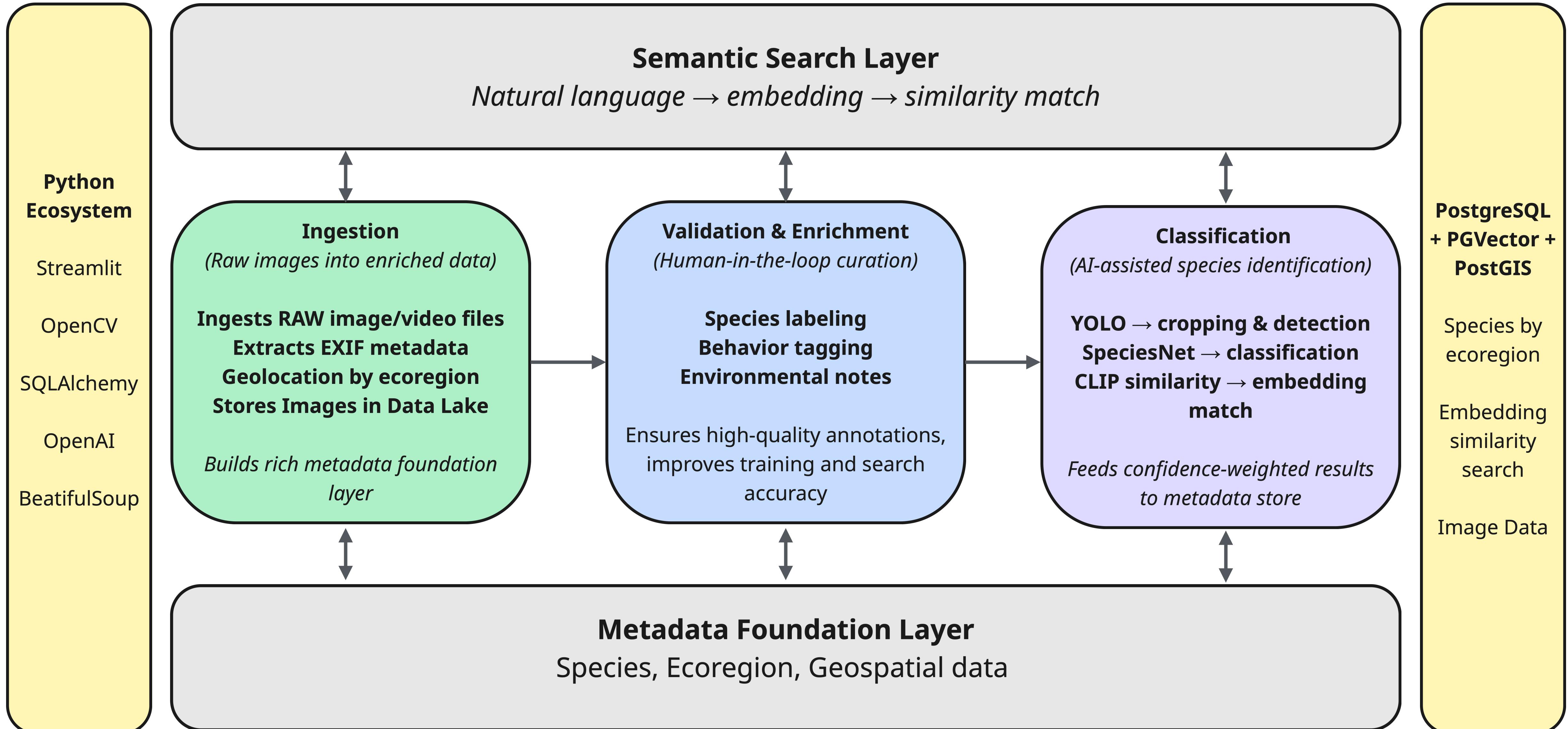
Link to Hummingbird: <https://vimeo.com/1095183654>



Wildlife Image Processing & Semantic Search System Architecture



From Field Capture to Searchable Insight



Link to Demo: <https://vimeo.com/1095187131>

Summary

Every image is a question. This system helps find the answer

- * Built a complete wildlife image processing system to turn photos into insights
- * Combined AI, spatial data, and semantic search to make observations smarter
- * Grounded species predictions in real-world ecology—location, behavior, habitat
- * Enables faster discovery of patterns in migration, seasonal changes, and biodiversity
- * Modular and extensible: adapts to new species, regions, and conservation needs
- * Designed for anyone documenting nature—photographers, researchers, citizen scientists

Q & A

Appendix

References

SpeciesNet

@article{gadot2024crop,
title={To crop or not to crop: Comparing whole-image and cropped classification on a large dataset of camera trap images},
author={Gadot, Tomer and Istrate, Ştefan and Kim, Hyungwon and Morris, Dan and Beery, Sara and Birch, Tanya and Ahumada, Jorge},
journal={IET Computer Vision},
year={2024},
publisher={Wiley Online Library}}

ExifTool

- ExifTool by Phil Harvey: <https://exiftool.org>

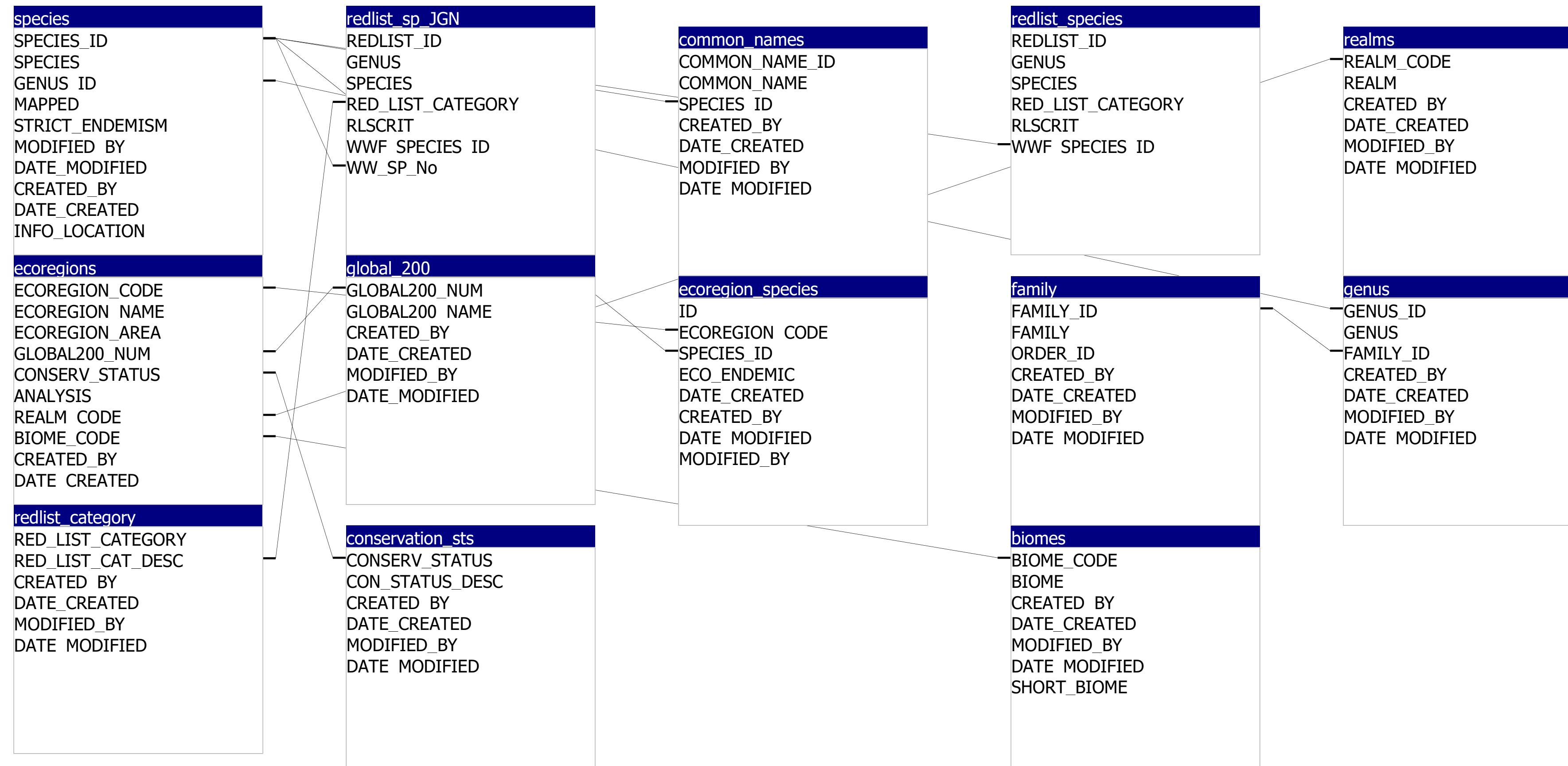
World Wildlife Fund

World Wildlife Fund. (n.d.). WildFinder database. World Wildlife Fund.

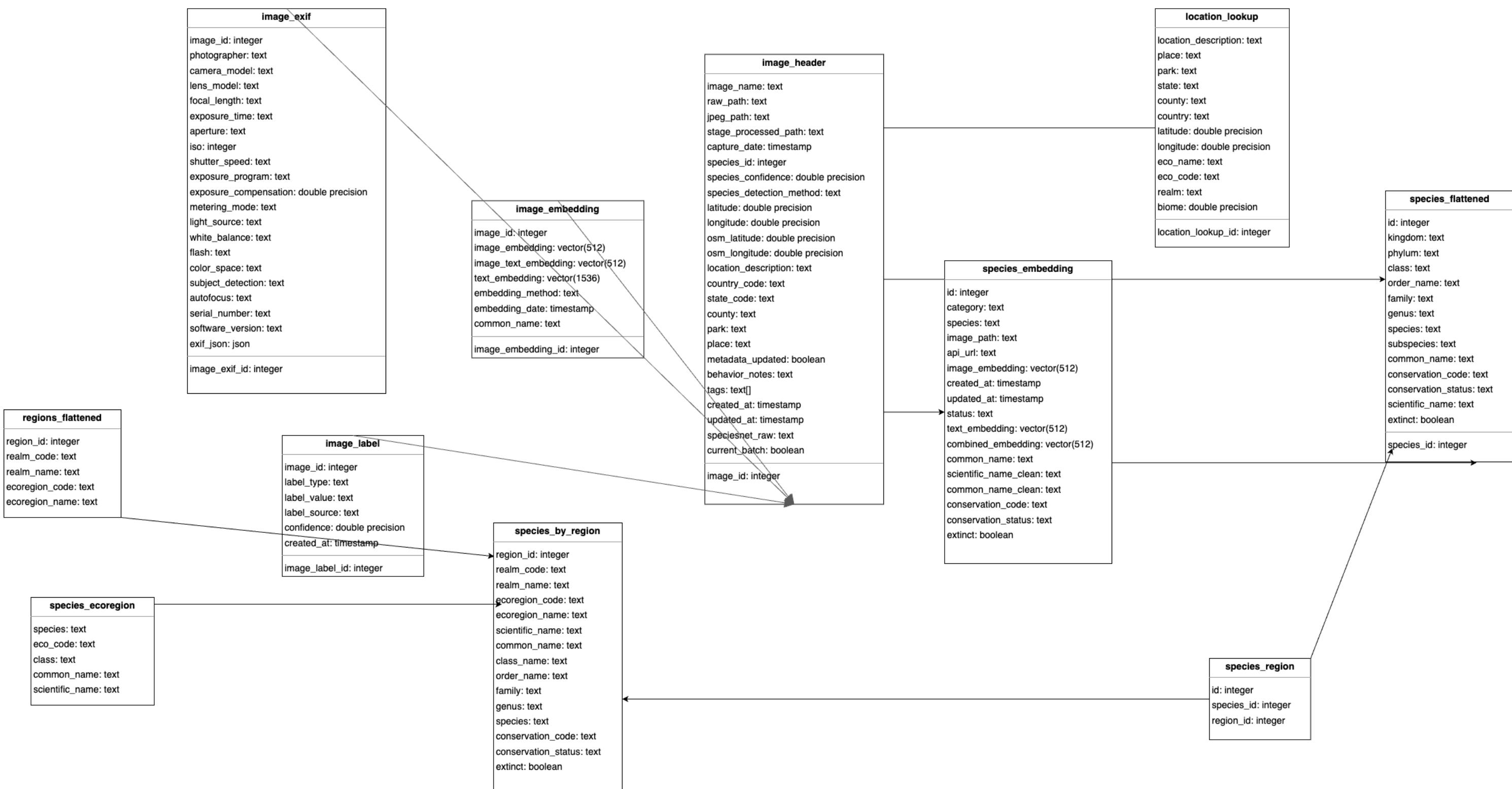
<https://www.worldwildlife.org/publications/wildfinder-database>

Relationships for WildfinderUpdate

Wednesday, June 18, 2025



```
1  -- =====
2  -- Function: get_ecoregion_by_coords
3  -- Purpose: Given a latitude and longitude, returns
4  --           the name, code, realm, and biome of the
5  --           ecoregion that contains that point.
6  -- Dependencies: Requires PostGIS and a populated
7  --                   ecoregion_polygons table with geometry
8  -- =====
9  CREATE OR REPLACE FUNCTION public.get_ecoregion_by_coords(
10     input_lat double precision,
11     input_lon double precision)
12    RETURNS TABLE(eco_name text, eco_code text, realm text, biome double precision)
13    LANGUAGE 'plpgsql'
14    COST 100
15    VOLATILE PARALLEL UNSAFE
16    ROWS 1000
17
18    AS $BODY$
19    DECLARE
20        geom geometry;
21    BEGIN
22        -- 1. Create point from lat/lon
23        SELECT ST_SetSRID(ST_MakePoint(input_lon, input_lat), 4326) INTO geom;
24
25        -- 2. Validate
26        IF geom IS NULL THEN
27            RAISE EXCEPTION 'Invalid coordinates: %, %', input_lat, input_lon;
28        END IF;
29
30        -- 3. Query containing ecoregion
31        RETURN QUERY
32        SELECT
33            ep.eco_name,
34            ep.eco_code,
35            ep.realm,
36            ep.biome
37        FROM ecoregion_polygons ep
38        WHERE ST_Contains(ep.geometry, geom)
39        LIMIT 1;
40
41        -- 4. Fallback
42        IF NOT FOUND THEN
43            RAISE EXCEPTION 'No ecoregion found for coordinates: %, %', input_lat, input_lon;
44        END IF;
45    END;
46    $BODY$;
47
48    ALTER FUNCTION public.get_ecoregion_by_coords(double precision, double precision)
49        OWNER TO wildlife_user;
```



| # | image_id | ≡ image_name | ≡ raw_path | ≡ jpeg_path | ≡ stage_processed_path | ≡ capture_date | # | species_id | # | species_confidence | ≡ species_detection_method | # | latitude | # | longitude | + |
|---|----------|--------------|---|---|--|----------------|---|------------|---|--------------------|----------------------------|---|----------|---|-----------|---|
| | 607 | _NZ85092.NEF | /Users/matt/media/raw/2024/10/04/_NZ85092.NEF | /Users/matt/media/stage_jpg/2024/10/04/_NZ85092.jpg | /Users/matt/media/stage_processed/_NZ85092.jpg | 10/4/24 17:52 | | 14708 | | 1 | speciesnet | | 45 | | -110 | |
| | 606 | _NZ85083.NEF | /Users/matt/media/raw/2024/10/04/_NZ85083.NEF | /Users/matt/media/stage_jpg/2024/10/04/_NZ85083.jpg | /Users/matt/media/stage_processed/_NZ85083.jpg | 10/4/24 17:52 | | 14708 | | 1 | speciesnet | | 45 | | -110 | |
| | 605 | _NZ85121.NEF | /Users/matt/media/raw/2024/10/04/_NZ85121.NEF | /Users/matt/media/stage_jpg/2024/10/04/_NZ85121.jpg | /Users/matt/media/stage_processed/_NZ85121.jpg | 10/4/24 17:53 | | 14708 | | 1 | speciesnet | | 45 | | -110 | |
| | 604 | _NZ85117.NEF | /Users/matt/media/raw/2024/10/04/_NZ85117.NEF | /Users/matt/media/stage_jpg/2024/10/04/_NZ85117.jpg | /Users/matt/media/stage_processed/_NZ85117.jpg | 10/4/24 17:53 | | 14708 | | 1 | speciesnet | | 45 | | -110 | |
| | 603 | _NZ84692.NEF | /Users/matt/media/raw/2025/05/25/_NZ84692.NEF | /Users/matt/media/stage_jpg/2025/05/25/_NZ84692.jpg | /Users/matt/media/stage_processed/_NZ84692.jpg | 5/25/25 11:34 | | 14937 | | 1 | speciesnet | | 45 | | -110 | |
| | 602 | _NZ84691.NEF | /Users/matt/media/raw/2025/05/25/_NZ84691.NEF | /Users/matt/media/stage_jpg/2025/05/25/_NZ84691.jpg | /Users/matt/media/stage_processed/_NZ84691.jpg | 5/25/25 11:34 | | 14937 | | 1 | speciesnet | | 45 | | -110 | |
| | 601 | _NZ89302.NEF | /Users/matt/media/raw/2025/01/05/_NZ89302.NEF | /Users/matt/media/stage_jpg/2025/01/05/_NZ89302.jpg | /Users/matt/media/stage_processed/_NZ89302.jpg | 1/5/25 12:13 | | 15215 | | 1 | speciesnet | | 44 | | -111 | |
| | 596 | _NZ89179.NEF | /Users/matt/media/raw/2025/01/04/_NZ89179.NEF | /Users/matt/media/stage_jpg/2025/01/04/_NZ89179.jpg | /Users/matt/media/stage_processed/_NZ89179.jpg | 1/4/25 16:27 | | 15215 | | 1 | speciesnet | | 45 | | -111 | |
| | 595 | _NZ85204.NEF | /Users/matt/media/raw/2024/10/05/_NZ85204.NEF | /Users/matt/media/stage_jpg/2024/10/05/_NZ85204.jpg | /Users/matt/media/stage_processed/_NZ85204.jpg | 10/5/24 8:29 | | 15215 | | 1 | speciesnet | | 45 | | -110 | |
| | 594 | _NZ86655.NEF | /Users/matt/media/raw/2025/05/28/_NZ86655.NEF | /Users/matt/media/stage_jpg/2025/05/28/_NZ86655.jpg | /Users/matt/media/stage_processed/_NZ86655.jpg | 5/28/25 16:44 | | 15215 | | 1 | speciesnet | | 45 | | -110 | |