P3: FINAL ERD TEAM-03

Business Problems and Objectives:

In the database design we are highlighting the need for efficient environmental data management and conservation efforts.The objectives include enhancing conservation impact, efficient resource management, fostering collaboration, and empowering outreach and education.

Modifications:

In the context of our database design, we started with an Entity-Relationship Diagram (ERD) that represented the structure and relationships of our data. However, we decided to make improvements to this ERD and convert it into an Enhanced Entity-Relationship Diagram (EERD) to better represent our data model.
One significant change we made in this process was related to two key entities: "wildlife" and "employee." Instead of keeping them as simple entities, we transformed them into super-types. This means that these entities now have common characteristics and attributes shared by multiple sub-types. For example, "wildlife" was divided into subtypes such as "omnivores," "carnivores," and "herbivores," depending on the specific characteristics and requirements of each category. Similarly, the "employee" super-type was subdivided into "sanctuary staff," "vets," "guides," and "coaches" to better represent the different roles within the organization.
Additionally, we addressed complex many-to-many relationships in our data model. In a many-to-many relationship, entities are often linked in a way that doesn't fit neatly into a relational database structure. To handle these situations, we introduced associative entities, which act as intermediary tables to resolve these relationships more effectively.
Overall, these changes in our EERD allow us to represent our data more accurately and efficiently, taking into account the specific characteristics and relationships between entities in our database.

Entities and Relationships :

1. TOURIST:

This entity represents tourists who visit different sanctuaries. It includes essential information about each tourist, such as their unique identifier (Tourist_ID), their associated guide (Guide_ID), and the sanctuary they visit (Sanctuary_ID). Additionally, it captures personal details like the tourist's name, phone number, and email.

- TOURIST to VISITS Relationship: This relationship indicates that tourists make visits to the sanctuary. The "TOURIST" entity is linked to the "VISITS" entity using the "Tourist_ID" as a reference. It signifies that each tourist, identified by a unique "Tourist_ID," can have one or more visits recorded in the "VISITS" entity. The "VISITS" entity contains details like "Sanctuary_ID," "Date_of_Visit," and "Feedback," implying tourists can visit multiple sanctuaries on different dates and provide feedback for each visit.

- TOURIST to GUIDES Relationship (Indirect through "GUIDES" entity): While there's no direct link between "TOURIST" and "GUIDES" shown in the diagram, it can be inferred from the context that tourists might interact with guides during their visits. However, the diagram doesn't explicitly depict how they are related.
- TOURIST to SANCTUARY Relationship (Indirect through "VISITS" entity): Though there's no direct connection between "TOURIST" and "SANCTUARY," the relationship between "TOURIST" and "VISITS" suggests that tourists visit sanctuaries. This indirect relationship can be deduced by associating the "Tourist_ID" in the "VISITS" entity with the "Sanctuary_ID."

2. SANCTUARY:

The Sanctuary entity describes the places that tourists visit. Each sanctuary is uniquely identified by its Sanctuary ID. It includes attributes like the sanctuary's name, location, and the area it covers. This information helps manage and differentiate various sanctuaries.

- SANCTUARY to VISITS Relationship: This relationship highlights that the sanctuary has visitors. The "SANCTUARY" entity is linked to the "VISITS" entity using the "Sanctuary_ID" as a reference. This signifies that each sanctuary, identified by a unique "Sanctuary_ID," can be visited multiple times by different tourists. The "VISITS" entity logs details such as the date of the visit and the feedback provided by the tourists.
- SANCTUARY to WILDLIFE Relationship (Indirect through "WILDLIFE_HABITAT" entity): The sanctuary houses various wildlife species, and their habitats are likely documented under the "WILDLIFE_HABITAT" entity. While there's no direct connection between "SANCTUARY" and "WILDLIFE" shown in the diagram, the link between the sanctuary and the habitats suggests that specific wildlife species might reside in particular habitats within the sanctuary.
- SANCTUARY to FLORA Relationship (Indirect through "FLORA_HABITAT" entity): Similar to the wildlife, the sanctuary also contains various flora. These plant species and their specific habitats might be documented under the "FLORA_HABITAT" entity. Although the "SANCTUARY" entity isn't directly linked to the "FLORA" entity, the relationship with habitats implies that different flora species are found in designated habitats within the sanctuary.
- SANCTUARY to HABITAT and FLORA_HABITAT Relationships: The sanctuary comprises different habitats, both for wildlife and flora. The relationship between "SANCTUARY" and "HABITAT" or "FLORA_HABITAT" entities indicates that each sanctuary has one or more designated habitats, which house specific wildlife or flora species.

3. VISIT (Associative Entity):

The Visits entity acts as a bridge between tourists and sanctuaries, allowing the system to record and manage tourist visits. It includes attributes like Visit ID (a unique identifier for each visit), Sanctuary ID (connecting a visit to a specific sanctuary), Tourist ID (connecting a visit to a specific tourist), the date of the visit, and feedback provided by the tourist.

- VISITS to TOURIST Relationship: The "VISITS" entity is linked to the "TOURIST" entity through the "Tourist_ID" attribute. This connection indicates that each entry in the "VISITS" entity corresponds to a specific tourist. This relationship helps in determining which tourist made a particular visit to the sanctuary.
- VISITS to SANCTUARY Relationship: The "VISITS" entity is also connected to the "SANCTUARY" entity via the "Sanctuary_ID" attribute. This relationship shows that each visit recorded in the "VISITS" entity is associated with a specific sanctuary. It allows tracking which sanctuaries a tourist has visited.
- Attributes within VISITS: Besides the foreign keys "Tourist_ID" and "Sanctuary_ID" linking the "TOURIST" and "SANCTUARY" entities, the "VISITS" entity also contains attributes like "Date_of_Visit" and "Feedback." These provide additional details about each visit, such as when the visit occurred and any feedback or comments the tourist provided about their experience.

4. WILDLIFE Entity:

This entity represents the wildlife that are habituated with the sanctuaries. Central to the conservatory, this entity keeps a record of all animals, ensuring they are well-taken care of and that their populations are stable. This entity captures essential information like their unique identifier (Wildlife_ID), and their associated Vets (Vet_ID). The Wildlife entity acts as a superclass which is totally specialized into the disjoint subtypes (HERBIVORE, OMNIVORE, CARNIVORE) using the subtype discriminator (Wildlife_type). It additionally captures details common between all subtypes like the population, species.

- WILDLIFE to WILDLIFE_FOOD Relationship: This relationship shows that each wildlife species consumes certain types of food. The "WILDLIFE" entity is connected to the "WILDLIFE_FOOD" entity, indicating the specific types of food that are suitable or preferred by each wildlife species.
- WILDLIFE to WILDLIFE_HABITAT Relationship: This relationship indicates that each wildlife species resides or is found in specific habitats. The "WILDLIFE" entity is linked to the "WILDLIFE_HABITAT" entity, documenting the various habitats that are home to different wildlife species.
- WILDLIFE to CARNIVORE, OMNIVORE, and HERBIVORE Relationships: These relationships define the dietary categories or feeding behaviors of the wildlife. The "WILDLIFE" entity is separately connected to the "CARNIVORE," "OMNIVORE," and "HERBIVORE" entities. This implies that each wildlife species can be categorized based on its feeding behavior or diet, be it carnivorous, omnivorous, or herbivorous. Each of these entities provides additional details specific to that dietary category, such as hunting strategy for carnivores or grazing patterns for herbivores.
- WILDLIFE to VET Relationship (Indirect through the "VET" entity): Although there's no direct link shown in the diagram between "WILDLIFE" and "VET," it's possible that vets may attend to specific wildlife species. The relationship might be inferred contextually, implying that vets are tasked with the health and well-being of the wildlife.

WILDLIFE - CARNIVORE Entity:

This subtype belongs to all the WILDLIFE entities that can be divided into the Carnivore category. This entity is used to uniquely track all the entities that are categorized as carnivores.
The entity captures essential information like the Carnivore_ID, that acts as the unique identifier as well as the foreign key used to connect it to the wildlife entity. This entity has some specific attributes like the Pack Size and the Hunting Activity Period which helps understand the time they prefer to hunt.

WILDLIFE - OMNIVORE Entity:

This subtype belongs to all the WILDLIFE entities that can be divided into the Omnivore category. This entity is used to uniquely track all the entities that are categorized as omnivores.
The entity captures essential information like the Omnivore_ID, that acts as the unique identifier as well as the foreign key used to connect it to the wildlife entity. This entity has some specific attributes like the Foraging Behavior and preferred Food.

WILDLIFE - HERBIVORE Entity:

This subtype belongs to all the WILDLIFE entities that can be divided into the Herbivore category. This entity is used to uniquely track all the entities that are categorized as omnivores.
The entity captures essential information like the Herbivore_ID, that acts as the unique identifier as well as the foreign key used to connect it to the wildlife entity. This entity has some specific attributes like the Seed Dispersal Strategy, Grazing Habits and Migratory Patterns.

5. HABITAT Entity:

This entity represents the different types of habitats that exist at the sanctuaries. It captures essential information like the unique identifier (Habitat_ID), It also captures the foreign keys that help it connect to the Sanctuary and Flora Entities using the Santuary_ID and Flora_ID respectively. It also captures additional information like the type of habitat (e.g., forest, grassland, wetland), and the size of the habitat. It also stores essential information like the PH level, Soil Fertility, Air Purity, Humidity and Temperature that are ideal for the habitat.

HABITAT to SANCTUARY Relationship: The "HABITAT" entity is associated with the "SANCTUARY" entity. This relationship denotes that each habitat is located within a specific sanctuary. The "Sanctuary_ID" serves as a reference to link habitats to the respective sanctuary they belong to.

HABITAT to WILDLIFE_HABITAT Relationship: This relationship reveals that specific wildlife species inhabit certain habitats. The "HABITAT" entity is linked to the "WILDLIFE_HABITAT" entity, which records which wildlife species are found in each habitat. This association helps in determining the biodiversity within each habitat.

HABITAT to FLORA_HABITAT Relationship: Similar to the wildlife habitat relationship, the "HABITAT" entity is also associated with the "FLORA_HABITAT" entity. This relationship denotes that

each habitat houses specific flora species. By connecting to the "FLORA_HABITAT" entity, it's possible to understand the plant biodiversity of each habitat.

Attributes within HABITAT: Apart from the relationships with other entities, the "HABITAT" entity might contain attributes that provide specific details about each habitat, such as its size, type, environmental factors like temperature and humidity, and other relevant characteristics.

6. WILDLIFE_HABITAT Associative Entity:

This entity acts as a bridge between the Wildlife and Habitat Entities. This entity represents the specific areas within the sanctuaries that are inhabited by different types of wildlife. It captures essential information like the unique identifier (Wildlife_Habitat_ID) as well as the foreign keys like the Wildlife_ID and Habitat_ID that connect the 2 entities together. It also captures additional information like the Date of Localisation, which will be used to track the date of the wildlife in the habitat.

WILDLIFE_HABITAT to WILDLIFE Relationship: The "WILDLIFE_HABITAT" entity is linked to the "WILDLIFE" entity through the "Wildlife_ID" attribute. This association shows that each record in the "WILDLIFE_HABITAT" entity corresponds to a specific wildlife species. It helps in determining which wildlife species are found in particular habitats.

WILDLIFE_HABITAT to HABITAT Relationship: The "WILDLIFE_HABITAT" entity connects to the "HABITAT" entity via the "Habitat_ID" attribute. This relationship means that each record in the "WILDLIFE_HABITAT" entity is related to a specific habitat. It allows tracking of which habitats are home to certain wildlife species.

Attributes within WILDLIFE_HABITAT: Apart from the foreign keys "Wildlife_ID" and "Habitat_ID" which connect to the "WILDLIFE" and "HABITAT" entities respectively, there may be other attributes within the "WILDLIFE_HABITAT" entity. These additional attributes would provide further details about the relationship between the wildlife and its habitat, such as the population of the species in that habitat, specific zones within the habitat they frequent, etc.

7. FLORA HABITAT:

The "FLORA_HABITAT" entity represents the natural environment or habitat where specific plant species or groups of plants live and grow."FLORA_HABITAT" entity is pivotal in an environmental conservatory setting, ensuring the well-being of plant species and subsequently the entire ecosystem. Proper management and understanding of this entity can lead to effective conservation strategies and a thriving natural environment. This attribute acts as the primary key or unique identifier for the FLORA_HABITAT entity, ensuring that each flora habitat can be distinctly recognized and referenced. Habitat_ID: It is an identifier associated with the "HABITAT" entity, which represents a specific environment or area where various species, both flora and fauna, can live and thrive. This is the primary identifier for each unique habitat within the conservatory or environmental database. It ensures that each habitat is distinctly recognized and can be referenced efficiently.

Flora_ID: Flora_ID is associated with the "FLORA" entity, representing a specific plant species or group of plants within the conservatory or environmental database. This is the primary identifier for each unique plant species or group of plants. It ensures that each flora entry can be distinctly recognized and accessed without confusion.

Relation with "FLORA": The "FLORA_HABITAT" entity has a direct relation to the "FLORA" entity. This relationship signifies which specific plant species or groups of plants are found within a given habitat. The relation can be represented as: one flora habitat can contain multiple flora species, and one flora species might be found in multiple flora habitats.

Relation with "WILDLIFE_HABITAT": The relationship between "FLORA_HABITAT" and "WILDLIFE_HABITAT" can be indirect. The presence and health of specific flora can affect the types of wildlife that can thrive in a given habitat, making this an important relationship to monitor and manage.

8. FLORA

"FLORA" entity has a relationship with "FLORA_HABITAT", indicating that each flora species might have one or more habitats or specific areas where they are commonly found. The "Flora_Habitat_ID" in the "FLORA_HABITAT" section might be a unique identifier for these habitats.

FLORA: This represents plants within the ecosystem or area.
Flora_ID: It appears to be the primary key (PK), which uniquely identifies each flora entry.
Species: Specifies the particular species of the plant.
Caretaker_ID: It's the primary key (PK) for the "CARETAKER" entity. This unique identifier distinguishes each caretaker from others. Every caretaker has a specific "Caretaker_ID" that can be used to reference them in the database or system.

FLORA to FLORA_HABITAT Relationship:This relationship indicates a connection between specific flora (plants) and their habitats. Each flora species might be associated with one or more habitats, signifying the areas or conditions where they are commonly found or thrive.
The connection between the two entities might be established through the "Flora_ID" in the "FLORA" entity and a corresponding identifier in the "FLORA_HABITAT" entity, ensuring each flora is correctly linked to its habitat.

9. WILDLIFE TRACKING:

"WILDLIFE TRACKING" entity is central to understanding and analyzing the movement and behavior of wildlife within the sanctuary or ecosystem. Its relationship with the "WILDLIFE" entity ensures that each tracking record is tied to a specific wildlife species or individual, providing valuable data for conservation and management efforts.

Attributes of WILDLIFE TRACKING:
Tracking_ID: A unique identifier for each tracking record.

Wildlife_ID: An identifier that references a specific wildlife species or individual.
GPS_Location: The geographical location, possibly provided by a GPS device, where the wildlife was tracked or spotted.
Tracking_Date: The date on which the tracking took place.

Relationships of WILDLIFE TRACKING:
WILDLIFE TRACKING to WILDLIFE Relationship: The "WILDLIFE TRACKING" entity is linked to the "WILDLIFE" entity through the "Wildlife_ID" attribute. This connection indicates that each tracking record corresponds to a specific wildlife species or individual. This relationship helps in understanding which wildlife species or individuals are being monitored and provides insights into their movements and patterns.

Potential Implications and Usage: The data within the "WILDLIFE TRACKING" entity can be used to understand movement patterns, frequent locations, and potential migration of wildlife within the sanctuary or ecosystem. It can assist in ensuring the safety and well-being of the animals by identifying areas of high traffic, potential hazards, or areas where human-wildlife conflicts might occur. Over time, analyzing this tracking data can help in making informed decisions about habitat protection, expansion, or modification to better serve the wildlife within the sanctuary.

10. EMPLOYEE:

"EMPLOYEE" entity is central to the management and operation of the sanctuary or organization. It captures essential details about the individuals working there and, through its relationships with other entities, provides insights into their roles and contributions to the sanctuary's mission and objectives.

"EMPLOYEE" entity represents individuals who are employed by the sanctuary or organization. Here's a description of the entity and its relationships:

Attributes of EMPLOYEE:
Employee_ID: A unique identifier for each employee.
Employee Name: The name of the employee.
Date of Joining: The date on which the employee joined the organization or sanctuary.

Relationships of EMPLOYEE:

EMPLOYEE to WILDLIFE Relationship: It appears there's an indirect connection between the "EMPLOYEE" and "WILDLIFE" entities, possibly through another entity (like "VET" or

"CARETAKER"). This suggests that certain employees might have specific roles or responsibilities related to the wildlife in the sanctuary.

EMPLOYEE to Other Entities: The diagram may show the "EMPLOYEE" entity connected to other entities that pertain to their roles or tasks within the sanctuary. For example, if there's an association with entities like "SANCTUARY STAFF", "VET", "CARETAKER", etc., it would indicate the specific roles or positions held by the employee within the organization.

The "EMPLOYEE" entity allows the sanctuary or organization to keep track of all its employees, their roles, and their duration of employment. The relationships with other entities provide context on the specific duties and responsibilities of each employee, whether it's direct care for the wildlife, administrative tasks, or other roles. The data within this entity can be crucial for administrative purposes, payroll, task allocation, and overall management of the sanctuary's operations.

11. VOLUNTEER:

"VOLUNTEER" entity is crucial for sanctuaries or organizations that rely on the goodwill and dedication of volunteers. It captures essential details about these individuals and, through its relationships, provides insights into their roles, contributions, and impact on the sanctuary's mission and activities. "VOLUNTEER" entity represents individuals who offer their time and skills to the sanctuary or organization without expecting monetary compensation. Here's a description of the entity and its relationships:

Attributes of VOLUNTEER:
Volunteer_ID: A unique identifier for each volunteer.
Name: The name of the volunteer.
Program_ID: An identifier that might link to a specific volunteer program or initiative.
Contact_No: The contact number of the volunteer.
Start_Date: The date on which the volunteer began their involvement with the sanctuary or organization.
End_Date: The date on which the volunteer's association with the sanctuary or program concluded.

Relationships of VOLUNTEER:

VOLUNTEER to OUTREACH PROGRAM Relationship: The "VOLUNTEER" entity is likely linked to the "OUTREACH PROGRAM" entity through the "Program_ID" attribute. This connection indicates that volunteers participate in specific outreach programs or initiatives run by the sanctuary or organization. It provides a clear picture of which programs or events each volunteer has contributed to.

VOLUNTEER to Other Potential Entities: Depending on the diagram, the "VOLUNTEER" entity might have connections to other entities, reflecting various roles, tasks, or areas where volunteers contribute. These could include areas like wildlife care, habitat maintenance, educational programs, and more.

Potential Implications and Usage: The "VOLUNTEER" entity enables the sanctuary or organization to manage and acknowledge the invaluable contributions of volunteers. The relationships with other entities, particularly "OUTREACH PROGRAM", help in tracking the involvement of volunteers in various programs, ensuring effective volunteer management and recognition. This data can be used for scheduling, communication, appreciation events, and to ensure the welfare and safety of volunteers during their time with the sanctuary.

12. OUTREACH PROGRAM:

"OUTREACH PROGRAM" entity represents the different outreach initiatives of the sanctuary or organization. Through its attributes and relationships, it provides a comprehensive overview of each program, its participants, and its interactions with other entities, helping in efficient program management and impact assessment.

"OUTREACH PROGRAM" entity pertains to the various programs or initiatives that the sanctuary or organization conducts for outreach purposes. Here's a detailed description of the entity and its relationships:

Attributes of OUTREACH PROGRAM:
Program_ID: A unique identifier for each outreach program.
Description: A brief description of the program, detailing its objectives, activities, and other relevant information.
Organisation_Name: The name of the organization or entity responsible for the program.
Date_of_Initiation: The date when the program was initiated or started.
Program Duration: The duration or time span of the program.

Relationships of OUTREACH PROGRAM:

OUTREACH PROGRAM to VOLUNTEER Relationship: The "OUTREACH PROGRAM" entity is linked to the "VOLUNTEER" entity through the "Program_ID" attribute. This connection indicates that volunteers participate or contribute to specific outreach programs. Through this relationship, the sanctuary or organization can identify which volunteers are associated with which programs and manage their assignments accordingly.

OUTREACH PROGRAM to Other Entities: Depending on the specifics of the diagram, the "OUTREACH PROGRAM" might have relationships with other entities. These could reflect collaborations, beneficiaries, or resources used in the program. For instance, there might be connections with "WILDLIFE", indicating programs focused on specific species, or with "TOURIST", indicating programs designed for visitors.

Potential Implications and Usage: The "OUTREACH PROGRAM" entity allows the sanctuary or organization to organize, manage, and review various outreach initiatives. It captures details that can be useful for planning, monitoring, and evaluating the effectiveness of these programs. The relationship with

"VOLUNTEER" ensures effective volunteer management, allowing the organization to assign volunteers to suitable programs, track their involvement, and ensure they have the necessary resources and support. Understanding the connections with other entities can provide insights into the scope, impact, and beneficiaries of each program, aiding in decision-making, resource allocation, and future planning.

13. WILDLIFE_FOOD (Assocative Enity):

Attributes:

Wildlife ID: This attribute serves as a reference to a specific wildlife entity and uniquely identifies a piece of wildlife within the database.
Food ID: This attribute is a reference to a specific food item and uniquely identifies different types of food in the database.
Quantity Supplied: This attribute represents the amount or quantity of food supplied to the wildlife. It indicates the specific quantity provided during a particular interaction.
Date Supplied: This attribute records the date when the food was supplied to the wildlife. It provides a time reference for when the feeding occurred.

Relationships:

- Many-to-One with Wildlife: This relationship signifies that multiple records in the "Wildlife Food" entity can be associated with a single wildlife entity. In other words, different instances of food supply (recorded in "Wildlife Food") can be linked to the same piece of wildlife.
- Many-to-One with Food: This relationship implies that multiple records in the "Wildlife Food" entity can be related to a single type of food. It means that various instances of food supply can be associated with the same food item.

14. FOOD :

Attributes:

Food ID: This attribute is a unique identifier for each type of food within the database. It serves as the primary key (PK) for the "Food" entity.
Food Name: This attribute specifies the name or label for a particular type of food. It helps in identifying and categorizing different food items.
Food Type: This attribute classifies the food into specific types or categories (e.g., fruits, vegetables, meat) based on the characteristics of the food.

Relationships:

- One-to-Many with "Wildlife Food": This relationship implies that a single type of food (recorded in the "Food" entity) can be associated with multiple instances of wildlife food. In other words, various interactions where this specific type of food is supplied to wildlife are linked to the same food item.
- One-to-Many with "Food Supply" (Associative Entity): This relationship signifies that a single type of food can be linked to multiple instances of food supply, as recorded in the "Food Supply" associative entity. It helps maintain records of food distribution and usage.

15. FOOD SUPPLY (Associative entity) :

Attributes:

Supply ID (PK): This attribute serves as the primary key and is a unique identifier for each supply transaction. It distinguishes different instances of food supply in the database.
Food ID: This attribute is a reference to a specific type of food and links each supply record to the corresponding food item.
Supplier ID: This attribute identifies the supplier responsible for providing the food. It references a specific supplier entity within the database.
Food Quantity: This attribute specifies the quantity or amount of food supplied during the transaction.
Restocking Date: This attribute records the date when the food was restocked in the inventory. It helps in managing the supply chain and ensuring an adequate food supply.
Date of Delivery: This attribute represents the date on which the food was delivered to the location where it is used for wildlife feeding.

Relationships:

- Many-to-One with "Food": This relationship indicates that multiple supply records in the "Food Supply" entity can be associated with a single type of food. It means that different supply transactions can involve the same food item.
- Many-to-One with "Supplier": This relationship signifies that multiple supply records in the "Food Supply" entity can be linked to the same supplier. It allows for tracking which supplier provided the food for various transactions.

16. SUPPLIER:

Attributes:

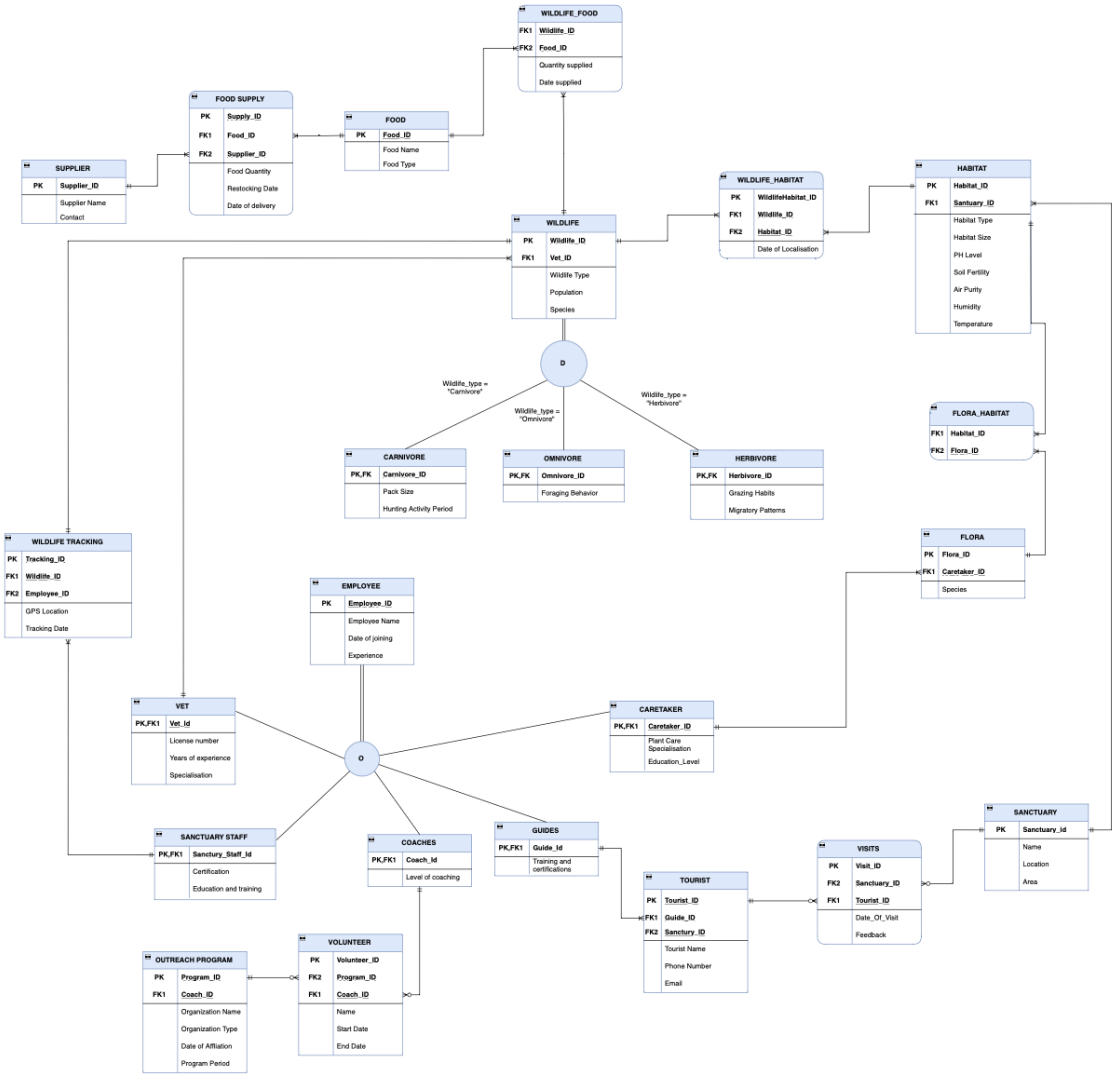
Supplier ID (PK): This attribute is the primary key and serves as a unique identifier for each supplier entity in the database. It distinguishes different suppliers from one another.
Supplier Name: This attribute specifies the name or title of the supplier organization or individual.
Contact: This attribute may contain contact information for the supplier, such as an address, phone number, or email.

Relationship:

- One-to-Many with "Food Supply" (Associative Entity): This relationship signifies that a single supplier entity (recorded in the "Supplier" entity) can be associated with multiple instances of food supply transactions, as captured in the "Food Supply" associative entity. It helps maintain a record of the various food supply activities performed by the same supplier.

Final ERD :

P3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Migratory Patterns
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