DRAWING NO.	REVISION	MODULE	LANGUAGE
RS-002	A	Environmental & Earth Science	English

Field Research Without a Lab: A Scope Guide

How to design a real environmental or earth science study using your own city, school, or neighborhood as the field site — and what permissions actually matter before you start collecting.

SKILL LEVEL: BEGINNER–INTERMEDIATE | TIMELINE: 4–10 WEEKS | EST. COST: $0–20

01 Objective

Environmental and earth science research doesn't need a university lab — it needs a real place, a repeatable measurement, and a comparison. Air quality near a busy road versus a park, water clarity upstream versus downstream of a specific point, temperature differences between shaded and unshaded urban areas — all of these are legitimate, ISEF-eligible studies you can run with low-cost tools or even none at all. This guide covers how to scope a field study that's actually measurable, what you're legally and ethically responsible for when collecting data outside your home, and how to avoid the single biggest mistake in this category: mistaking one measurement for a trend.

02 What Makes a Strong Project in This Category

The strongest field science projects share one structural feature: a genuine **comparison**, not just a description. "I measured the air quality near my school" is an observation, not a study. "I compared PM2.5 levels at three points along a single road at three times of day, over five repeated days" is a study — it has a controlled comparison, repetition, and a question a result could actually answer.

03 Choosing Your Scope

WORKED EXAMPLE — NARROWING A TOPIC

Too broad: "Is my city's air polluted?"

Still too broad: "Is traffic pollution a problem near schools?"

Researchable: "Is there a measurable difference in PM2.5 concentration at three fixed points with varying distance from a main road, measured at the same time of day across five consecutive school days?"

The researchable version fixes the location, the timing, and the repetition — the three things that turn a single measurement into real evidence.

04 Methodology & Data Collection

- **Low-cost measurement tools.** Consumer-grade air quality sensors, pH/water test strips, simple sound level meter apps, and thermometers are all legitimate instruments for a student study — what matters is using the *same* instrument, calibrated the same way, for every measurement.
- **Control for confounds.** Weather, time of day, and season all affect environmental measurements independently of what you're testing. Record these alongside your main variable so you can account for them, or hold them as constant as possible (e.g., always measuring at the same hour).
- **Replicate every measurement.** A single reading at one point in time tells you almost nothing about whether a difference is real or just noise. Take multiple readings at each site/time and report the range, not just one number.
- **Biological sampling** (collecting plants, insects, water samples with organisms) has extra rules — covered below.

05 Compliance & Ethics — Read Before You Collect Any Data

PERMISSIONS DEPEND ON WHERE AND WHAT YOU'RE COLLECTING

ISEF requires legal and ethical compliance for any specimen or sample collection, and site access is your responsibility to arrange — not something to assume.

- **Site access.** If your measurement site is private property, a park, or protected land, get explicit permission from the landowner or managing authority before collecting there — a public street is generally fine, but don't assume for anywhere else.
- **Biological specimen collection** (plants, insects, water samples containing organisms) may require a collection permit depending on your location and what's protected there — check with your Adult Sponsor and local environmental authority before collecting, not after.
- **Vertebrate animals** (any study observing or involving animals with a backbone) fall under separate ISEF rules entirely (Forms 5A/5B) — if your project touches this at all, get guidance from your Adult Sponsor before designing the study, not after.
- **Field safety.** Never collect data alone at an unfamiliar or potentially unsafe site — bring a parent, teacher, or peer, and tell someone your location and expected return time.

06 Analysis & Interpretation

DATA TYPE	EXAMPLE	STARTING ANALYSIS
Repeated measurements at fixed points	PM2.5 at 3 locations, 5 days	Average per location, range/variability, compare averages across locations
Measurements over time	Temperature logged hourly over a week	Line graph of trend, identify daily/weekly patterns
Presence/absence or counts	Species counted per site	Compare counts across sites, note any confounding differences between sites

Always report your instrument's precision honestly — a consumer air quality sensor is not a research-grade instrument, and saying so in your write-up is a sign of good scientific practice, not a weakness.

07 Common Pitfalls

MISTAKE	WHY IT'S A PROBLEM	FIX
One measurement presented as a trend	A single data point can't show change over time or a real difference	Always take repeated measurements before drawing a conclusion
Ignoring weather/time-of-day effects	These often explain a "finding" better than your actual variable does	Record and control for them explicitly
Collecting specimens without checking permits	Can disqualify the project and has real legal/ecological consequences	Check with Adult Sponsor and local authority before any collection
Fieldwork alone at an unfamiliar site	Safety risk	Always bring someone and share your plan

08 Where This Goes Next

From scope guide to submission

A well-controlled field comparison with proper permissions is exactly what ISEF's *Earth & Environmental Sciences* category is looking for. See *The Project Blueprint* in the ISEF & University Playbook for turning your results into a compliant abstract and board.

If your field study involves continuous data logging over days or weeks, the SD-card and RTC techniques from **BP-002 (Real-Time Data Logging)** in the Engineering Vault apply directly — you can automate the exact repeated measurements this guide asks for.